CHEMICAL & METALLURGICAL ENGINEERING

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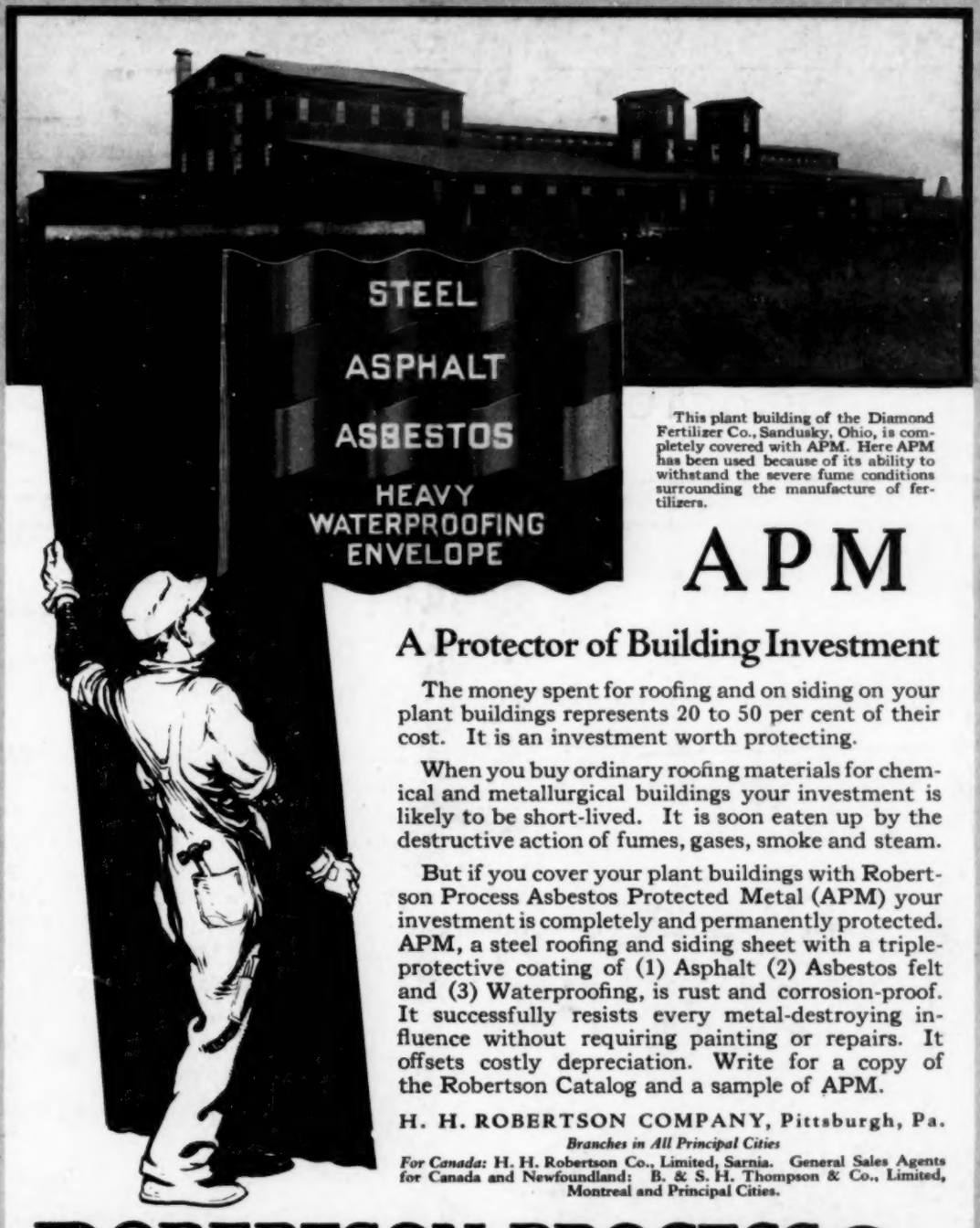

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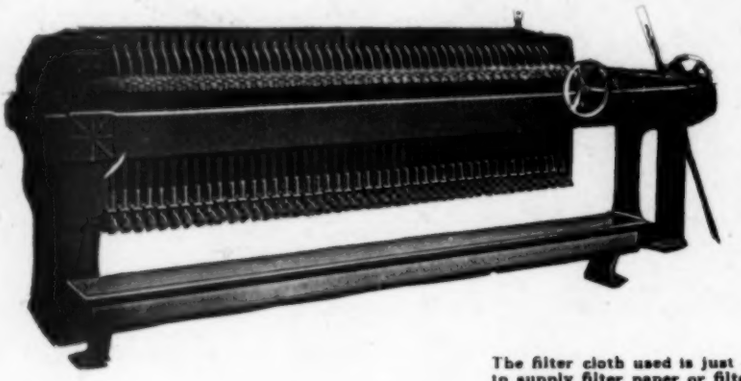

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H. C. PARMELEE, Editor

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"Tut-ankh-Amen's Vengeance" And Its Commercial Parallel

NEWSPAPER announcements of the illness and subsequent death of Lord CARNOVAN were followed by wild stories and rumors suggesting the vengeful spirit of King TUT-ANKH-AMEN as the direct cause. Although we attempt to laugh off such foolishness, back it comes, this time sponsored by the senescence of Sir ARTHUR CONAN DOYLE. If this curious mental attitude confined itself to explaining the Earl's untimely death, we might ignore it as a form of harmless idiocy; but it has more sinister phases. As exemplified by the anti-Darwinism of WILLIAM JENNINGS BRYAN, for example, it has been the signal for direct attack against modern science in school and college. This is serious, to be sure, although ultimately it should stimulate scientific men to a united effort in defence of science and scientific research.

There is a phase of this superstition, or a credulity that is closely allied to it, which affects us more directly. It is the peculiar lure of speculation that leads the investor into the realm of the questionable enterprise and the "blue-sky" security. Given two opportunities, one a legitimate, carefully planned manufacturing venture and the other a plain, hungry wildcat, a goodly share of the investing public will flock to the wildcat if for no other reason than the seductive superlatives in its promoter's prospectus.

Striking examples of wild gambles of this sort have recently been unearthed in the government's investigations of the use of the mails by fake oil-stock promoters' schemes. At a round-up at Fort Worth, Tex., such notable crooks as "Doc" COOK of North Pole fame and his "high-powered" publicist, S. E. J. COX, were hauled in along with the evidence that they had mulcted the public out of more than $6,000,000. The acting United States Attorney-General in charge of the prosecution has stated that credulous investors in this country are daily contributing over $100,000 to just such flagrant swindles.

This is the sort of superstition that always has been and is still a real menace to progress. It is the old drive to get something out of nothing. It is not begotten of ignorance so much as it is of stupid credulity. The crooks do not appeal to the hard-headed men of business; they cast their nets for the dull, weary people who can't produce with their heads and therefore must labor long and arduously with their hands. Or for women without experience in the ways of the world who know only that some get rich and some don't, but can't imagine any other reason for it than luck or chicanery. How to establish a beneficent guardianship for these easy marks who lack the wit to manage their own affairs is a never-ending problem. Perhaps a later and wiser generation of law-makers or law-givers will solve it.

In the meantime many of our technical men are producing ideas for legitimate enterprises that are needed in industry and are sound in conception, with abundant potential earning power. They are desirable in every way, but are held back by the lack of funds required to launch them. They are kept in check while this very stream of wealth seeking "investment" according to the illusions of its owners passes over the falls and under the bridge into the pockets of adventurers. It never comes back.

We are not interested in the notions of the oratorical WILLIAM JENNINGS BRYAN as to the faith of our fathers or in the number of ghosts Sir ARTHUR sees and hears. But we are interested in a more energetic and vigilant administration of justice in dealing with those who prey upon the innocent or ignorant and in the maintenance of higher standards in the licensing of corporations. We need both reforms.

Profit Sharing In a Small Plant

SOMETIMES we have been guilty of thinking of profit-sharing schemes as sort of frills that only the large, rich organizations can afford. They seemed to be something rather intangible that belonged in the realm of overhead and were properly charged off to good will and advertising. Recently, however, we have been forced to revise our notions, for our attention has been called to a successful system of profit sharing which a small Eastern manufacturer of chemicals has carried on uninterruptedly for more than 17 years. Although perhaps not entirely novel, the system is so interesting and its results so unique that we should like to share its story with our readers.

The scheme is based, of course, on a contract between the employer and his workmen. In return for the worker's promises to do his work quickly and carefully and to give his employer 2 months' notice before leaving, he receives a certain proportion of the company's profits. One-half of this sum is given in cash to the employee and the other is deposited to his credit in a savings bank. The employer, however, is the sole trustee of the savings fund, although it is never allowed to revert to him. If the employee dies the fund is given over, with interest, to his family. In case of sickness the employer can divert a part, or all of it, to the employee, and in addition to this relief the worker is kept on the payroll at half pay. Should the employee leave the company or be discharged for cause, the fund is distributed among the other participants at the next division of profits.

In 1905, when the system was begun, there were

twenty-one profit sharers; today there are forty-two. During these 17 years the employees received $40,464. The first payment was 10 per cent of the total payroll and the last was 21.3 per cent, although in each case the proportion of the total profit was the same. What do these figures show? Do they prove that the bargain has been a good one? A letter from the general manager of the plant addressed to the National Industrial Conference Board answers these questions quite conclusively. In this connection the employer writes:

"Inasmuch as my profits compared to the wages paid have increased, it seems to be obvious that the efficiency of my workers has improved; but above all, my own observation has convinced me that the morale of my employees is much superior to the average and that they are more contented and more willing, by far, than is usual in similar establishments. In fact I am satisfied that this bargain has been a good bargain—a good one for both parties to it—and that the extra money I have paid out has been well and profitably invested."

If this story has a moral, and we believe it has, it is simply this: What's good for a large manufacturer is usually good for the small one provided that it is based on sound principles and is wisely applied. Profit sharing is fundamentally a good policy and it makes no difference whether it is carried out on a large or a small scale. The results are the same.

Putting a Value On Education

IN A LATE number of *Commerce and Finance* E. J. BODMAN, a banker of Little Rock, Ark., contributed an article on agricultural education, a subject in which he takes a live interest. If all the farmers of Arkansas, he says, had secured from their crops and animals the same results as those obtained last year by the 3,000 pupils taking farm training at rural schools in that state, Arkansas' farm income would have been increased by no less than $217,532,000. He further declared that of all the people of the United States that have performed distinguished services and have been rewarded with high honors there was but one person out of each 150,000 who had had no schooling; one out of each 37,500 who had had a common school education, one out of each 1,724 who had completed high school, and one out of 187 who had a college degree. Of 5,000,000 persons with no schooling only 31 had attained distinction, whereas no less than 5,678 out of 1,000,000 persons with a college degree had done so. There are 277 times as many college graduates in the United States who have achieved great wealth as there are wealthy men without such a degree.

So much for that. We all know that it is right and proper to be good boys and to study hard and to mind teacher. It goes without saying. But here is a complaint from an eminent professor of physical chemistry. "I'm getting fed up with seniors," he exclaimed. "They're so sophisticated they are not interested in anything simple. They don't know anything—but they don't realize that. When I get a clear, succinct exposition of a difficult problem and give it to my post-graduate students they chortle with delight. Seniors don't want to know anything that may be expounded in simple words. I have to use abstruse terminology with them to keep their attention. They eschew curiosity, which ought to be their most precious possession. It is a quality without which it is useless to approach physical chemistry. My post-graduate students, on the other hand, are like children. They want to know why and to sense every reason. They're busy and they want to do something, to accomplish something. They don't want frills; they're after facts. I have to work harder with them, and this involves using the simplest language I can find."

There are three kinds of men: Those who will get the means to solve their problems and satisfy their curiosity, whether they have the "chance" or not. They are supreme. Secondly, we have those who profit by their opportunities. But the third and largest class consists of those who merely take what comes. They have no curiosity. They are not worth educating. Their proper place is in the yard-gang, digging ditches, or at the filing cabinet in the office. There is no place for them in our profession.

An Idealists' Plaything

WHEN you stop to think of it, you will remember that many of the greatest of our scientific discoveries were made with absurdly simple apparatus. Doubtless FARADAY'S whole experimental laboratory could be duplicated for the cost of one intricate testing machine. It's the experimenter rather than the equipment that counts.

All of which is somewhat trite and obvious, yet strangely enough seemingly ignored by excellent agencies for fostering research. Some of the investigations are started, evidently on the theory that if enough men get interested in it, and enough tests are made, enough variables introduced and eliminated, then somehow from this Irish stew will come the effusive odor of inspiration.

It just doesn't work that way! Some thinker who doesn't need to be co-ordinated will devise a little model—only a wooden block sliding on a stick—to illustrate the plastic flow of a metallic crystal and presto, the whole mechanism of fatigue failure is explained! Not only qualitatively, but quantitatively. Properly designed, it predicts the action of a metallic specimen with uncanny precision. Undoubtedly the model might well say for itself, "I could have foretold the whole of the results of the tests which have taken you years to make."

The steady plodder who runs exhaustive (and exhausting) tests can truly retort that only by comparison with his determinations does the model acquire credence. True enough. But such a model as Professor JENKIN'S (described elsewhere in this issue) helps us to understand the true mechanism of fatigue, and demonstrates most tangibly the more or less abstruse conclusions of the theorist. It points to conclusions which can be readily checked. It guides experimentation. It furnishes quick and highly probable indications of what would happen under unusual conditions: unbalanced stresses, occasional heavy shocks, periods of rest, duplicate heat treatments—problems which would take unthinkable patience and enormous expense to solve by direct attack.

Another great use for such a toy is to illustrate the action of ideally perfect material. It reproduces the essential actions, meanwhile eliminating the influence of many obscure variables, whose very existence may be unsuspected. Too often a deal of work is done on

metal which is of unknown origin and doubtful uniformity. The results apply to that particular experimental piece, but have questionable generality. Thus we come to the dilemma of the committee which tested the effect of sulphur in rivet steel. They examined minutely several steels, well-made steel too, uniform as near as might be except for sulphur. Some differences in physical properties were measured, but these variations are probably due to something besides sulphur! What that something is, is a mystery. In other words, unknown material was examined with microscopic exhaustiveness; mere repetition of tests is futile.

It might not be amiss for some experimenters to look up from their testing machines long enough to insist upon material as uniform as their tests or to devise a toy model, a mechanical equivalent. Meantime Professor JENKIN'S plaything approaches the ideal ductile crystal so closely that if a sample of metal under fatigue test does not agree with the predicted action, we shall suspect abnormal metal rather than mistaken theory.

Fluorspar Resources— Past, Present and Future

THREE principal uses of fluorspar are for flux, for enamel and opalescent glass, and for chemical operations, such as the manufacture of hydrofluoric acid and fluorides. For fluxing purposes it is customarily required that not less than 80 to 85 per cent of calcium fluoride be present in the spar. The glass and enamel grade is usually expected to be 95 per cent or better. But for chemical uses, manufacturers generally specify spar of 98.5 or 99 per cent purity. All three of these grades are available in reasonable quantities today, although the American production, which in the past has commonly maintained the bulk of the supply of the world, is now being supplemented to some extent by imports. Those that have studied this subject most are convinced that within 5 or 10 years there is likely to be a decided shortage of the better grades of domestic fluorspar. All three of the principal groups of users will do well, therefore, to consider the situation at once, not waiting until the shortage, forecast today, actually confronts them.

These untoward prospects have already induced some of the large consumers to purchase important deposits or to take options on territory where such deposits are believed to be available. The government has also interested itself in the question and has undertaken to determine what foreign sources of flourspar there may be that are worthy of future consideration. But there is room for the chemical and metallurgical industries to attack this problem, particularly from the technologic viewpoint.

One of the most important problems will be the preparation for using lower grade spar for chemical purposes, in place of the very high grade now required. Perhaps today an 85 per cent spar cannot readily replace the 98 per cent material for the manufacture of fluorides, but the time may soon come when the increase in cost involved in this use of lower grade material will be less than the difference in the market prices of the two grades. And this may be expected soon unless special means for concentration and refining are developed by the mining industry.

The only alternate source of fluorine is cryolite, and present prospects are that cryolite of first quality will not be available at a more attractive price than high-grade fluorspar. These are practically the only two minerals known that contain fluorine in quantity sufficient to make them interesting to the fluorine-using industries. The logical conclusion from these facts is that the use of lower grade material will eventually come, first as a matter of economy, and a little later as a matter of necessity.

In the case of enamel manufacture and fluxing, there are undoubtedly other means of gaining substantially as satisfactory results as are now obtained with fluorspar. In some glass and enamel, cryolite is already used by many in preference to the combination of fluorspar and feldspar. But still further progress in an entirely different direction, by the use of other types of enamels, may be essential. It is none too soon to begin investigation of alternative possibilities.

Present conditions indicate that foreign sources of supply may be found where high-quality spar can be mined in such large quantities as to offset completely any prospective shortage from domestic sources. Although the location and extent of such deposits are as yet unknown, it is not until this possibility has been thoroughly investigated that we need be at all alarmed about the future. Even though such resources are developed, however, it will be a distinct advantage to industry to have an alternative procedure through the operation of metallurgical, enameling and chemical processes, without the necessity for using imported spar. It all comes down to our old story: Improvements in technology are to be preferred to dependence solely upon foreign resources.

Indexing Technical Journals

A CORRESPONDENT writes suggesting that we arrange for the compilation of a composite index of all that has appeared in *Chem. & Met.* and its predecessors, covering a period of the last 20 years. To us such a plan presents two serious disadvantages: The cost, although not by any means prohibitive, would be out of all proportion to the value to our readers, since it is only occasionally that reference is made to what is contained in the older volumes. Further, the plan is unattractive because it makes no provision for the future. If such a task is undertaken only every 20 years, it is clear that a sudden burden of work would be involved for which a special provision would be required. On the other hand, if the index were kept up to date, week by week or month by month, its inaccessibility to the average reader would make it valueless. Five or 10 years after one composite index had been published a limited though vehement demand for another would arise. The expense would be considerable and, we believe, unjustified.

Most of the trouble in tracing articles in back numbers is due to the necessity of handling the volumes in order to consult the index. We believe that reference would be facilitated if, in addition to the index bound in each volume, subscribers could purchase, for a nominal sum, bound or unbound copies of additional indexes, covering a period, say, of 5 years. Some of our readers have been doing this in the past. If there are others that desire this service, we should be glad to have a sufficient number of extra copies of our next index printed and reserved for special distribution. It seems probable that such a combined index, kept continually up to date, would prove a valuable addition to the technical bookshelf.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials in *Chem. & Met.* or on other topics of pertinent interest

The Purpose Of a Standard

To the Editor of Chemical & Metallurgical Engineering

SIR:—It seems to me that the three fundamental functions outlined in the editorial[1] on "The Purpose of a Standard" are very clearly and succinctly presented. I have no criticism to offer on any one of them. However, it seems to me that the list is incomplete. Is not a principal purpose, if indeed not the most important purpose, the industrial economy which results to consumer and producer alike by concentrating production and utilization on specific products, whether they be defined by purchase specifications, by nomenclature or by denominational standards?

Subsidiary to the important purpose of bringing about industrial efficiency are such matters as: conserving and actually making use of the advances in the industry; simplifying the processes of production and distribution; and cutting down selling costs.

The attached list of fourteen advantages of industrial standardization was compiled for a different purpose than the editorial, but it occurred to me that it might be of interest to your readers in this connection.

P. G. AGNEW,
Secretary.
American Engineering Standards Committee.

New York City.

Industrial Significance of Standardization

1. Stabilizes production and employment, since it makes it safe for the manufacturer to accumulate stock during periods of slack orders, which he cannot safely do with an unstandardized product.
2. Reduces selling cost. This is generally overlooked. Possibilities of reduced costs are generally even greater in distribution than in production.
3. It enables buyer and seller to speak the same language, and makes it possible to compel competitive sellers to do likewise.
4. In thus putting tenders on an easily comparable basis, it promotes fairness in competition, both in domestic and in foreign trade.
5. It lowers unit costs to the public by making mass production possible, as has been so strikingly shown in the unification of incandescent lamps and automobiles.
6. By simplifying the carrying of stocks, it makes deliveries quicker and prices lower.
7. It decreases litigation and other factors tending to disorganize industry, the burden of which ultimately falls upon the public.
8. It eliminates indecision both in production and utilization—a prolific cause of inefficiency and waste.
9. By concentrating on fewer lines, it enables more thought and energy to be put into designs, so that they will be more efficient and economical.
10. By bringing out the need of new facts in order to determine what is best, and to secure agreement on moot questions, it acts as a powerful stimulus to research and development, and it is thus in decided contrast to crystallization resulting from fixity of mental attitude.
11. It is one of the principal means of getting the results of research and development into actual use in the industries.
12. It helps to eliminate practices which are merely the result of accident or tradition, and which impede development.
13. By concentration on essentials, and the consequent suppression of confusing elements intended merely for sales effect, it helps to base competition squarely upon efficiency in production and distribution and upon intrinsic merit of product.
14. Standardization is increasingly impotent for the maintenance and development of foreign trade. There is strategy in nationally recognized "American" specifications.
15. The efficiency of competing countries, increasing through national standardization programs, is liable to transfer competition from foreign markets to our own shores.
16. Joint effort in bringing about standardization within and between industries almost invariably leads to better understanding and to beneficial co-operation along other lines—a step toward the integration of our industries.

[1] Vol. 28, No. 11, p. 479, March 14, 1923.

Some Recent Technical Developments in Great Britain

An enterprising Sheffield steel manufacturer is about to place on the market a stainless silver, which is the result of recent research, probably inspired by the success of stainless steel. The wastage and labor involved in cleaning silver articles are quite comparable to those now saved by stainless steel, but the difficulty has been that in order to obtain the hall mark, the silver content of an article must exceed 92½ per cent, which leaves a smaller margin for additional ingredients than has been found desirable in the production of stainless steel. It is stated that the new silver will remain bright for about 2 years without cleaning.

Attention has also been drawn to the claims for "Usco" alloy for furnace castings made by the International Combustion Engineering Co., Ltd. The properties of this material are stated to be such that while costing about 50 per cent more than cast iron, it will last from three to ten times as long at temperatures between 800 and 1,000 deg. C.; further, that the melting point is materially higher and while giving a practicable foundry mixture, the castings have high tensile strength and do not crack in use.

Although steam heating or oil or water circulation is generally considered as standard for temperatures up to 500 deg. F., a simple device such as the Stirling stove, made in Sheffield, England, deserves to be better known and appreciated. The underlying principle is the use of a number of special inclined steam tubes, the lower ends of which project through the back wall of the stove into the furnace, which burns coke. Each tube is a separate unit into which a small and definite quantity of water has been introduced before it is closed up. When heated up in the furnace, each tube is filled with steam at a high temperature, which gives up its heat to the stove. This, on condensing, runs back again to the furnace, the process being continuous so long as the fire is kept going. The cost of tubes and furnace ironwork to maintain 350 deg. F. in a stove 6x5x5 ft. is about $175 and the fuel consumption would be about 500 lb. of coke per week. The principle should be capable of adaptation to other items of chemical equipment.

Methods of Air Drying

A Discussion of the Theory and Practical Difficulties as Well as Comparison of the Different Methods of Drying Air

By Edwin C. Holden
Consulting Engineer, Baltimore, Md.

THE number of metallurgical, chemical and other manufacturing processes requiring an atmosphere of anhydrous or exceedingly low-moisture air for advantageous operation is constantly increasing, and it is probable that there are many such for which the possibility of obtaining dry air has never been considered, but which would be greatly improved by anhydrous or at least arid working conditions.

In the following notes the attempt is made to give theoretical and practical data on the various methods of air drying which may assist a plant manager to decide upon the practicability of dry air for his requirements. For the same reason British units are used wherever convenient.

The drying of air or other gases, as here discussed, is defined as the reduction of the quantity of water vapor present per unit of volume and mass, or its complete removal, as distinguished from air-conditioning processes wherein the percentage of humidity is controlled by change of temperature without changing the mass relations, or where, by washing, steam injection, wet filters, etc., the aqueous saturation is increased.

Air-Drying Methods

There are four possible methods of drying air—namely, by contact with deliquescent or dehydrating salts or acids; by compression with cooling, condensation and separation of condensate; by refrigeration with condensation and separation of condensate, and, finally, adsorption by substances with ultra-microscopic porosity.

Heating air, while it reduces the percentage saturation, does not reduce the mass ratio of vapor to air, and therefore does not come within our definition of air drying.

I—Drying by Reagents

Desiccation by exposure to caustic or other deliquescent salts is effective to the limits corresponding to the vapor pressures over them when equilibrium is attained.

The important chemical desiccators and their aqueous vapor pressures are given in Table I.

TABLE I

Vapor Pressure in mm. of Mercury Over	At 0 Deg. C.	At 25 Deg. C.	At 50 Deg. C.
KOH	....	....	0.007
$CaBr_2$	0.09	0.18	0.19
$CaCl_2$*	0.07	0.34	1.34
NaOH	0.04	0.15	1.15
$ZnCl_2$	....	0.85	2.19
$ZnBr_2$	0.28	1.16	6.34

According to Baxter† the weight of water in milligrams in a liter of air after being dried by various agents is

H_2SO_4 at 50 deg. C.	0.003
KOH at 50 deg. C.	0.007
NaOH at 25 deg. C.	0.16
$CaBr_2$ at 25 deg. C.	0.2
$CaCl_2$* at 25 deg. C.	0.36
$ZnCl_2$ at 25 deg. C.	0.8
$ZnBr_2$ at 25 deg. C.	1.1

*Meaning $CaCl_2$, $CaCl_2$, H_2O.
†*J. Am. Chem. Soc.*, vol. 33, p. 340, and vol. 38, p. 2038.

Phosphorus pentoxide (P_2O_5) is the most effective desiccator. According to Morley‡, it leaves not more than 1 mg. of water in 40,000 liters of air. Because of its cost it is applicable only to laboratory work, and even with it absolute dryness is not theoretically obtainable.

With the other salts an atmosphere approaching equilibrium is obtained by passing the air through a bed or tube newly charged with the lump salts. The latter gradually lose efficiency as the surfaces take up moisture, and the lumps finally break down or coalesce in a sticky mass, so that the operation is intermittent and the spent material is corrosive and inconvenient to handle.

These difficulties and the cost of the reagents are the practical limitations to this method of drying, but it has until recently been the most satisfactory practice in the air products manufacturing industry.

Drying by Sulphuric Acid

Sulphuric acid of 65.4 deg. Bé. (90 per cent) or stronger has an aqueous vapor pressure below 0.5 mm. of mercury even at 100 deg. C. It is, therefore, an excellent desiccating agent when complete contact is obtained and if the acid be replaced before dilution below 90 per cent at 100 deg. C. or 89 per cent at 80 deg. C.

Concentrated sulphuric acid is an excellent desiccating agent in the laboratory, where there is usually ample time for diffusion to attain equilibrium. The objections to it as a commercial desiccator are the high cost of 66 deg. Bé. acid, the impossibility of quickly obtaining complete contact without sprays, the danger of entrainment of acid mist from sprays, the corrosive action of the acid as it becomes weaker than 50 deg. Bé., the necessity of acid-proof cooling coils and large quantities of cooling water to remove the evolved heat of solution and thus maintain the lowest possible aqueous vapor tension, and, finally, the high heat consumption and costly equipment required to reconcentrate the acid. For commercial plants 60 deg. Bé. acid should be used, as higher grade acid is usually made to meet strict specifications as to purity and sells at a high price per unit of H_2SO_4 content.

Fig. 1 is a chart showing the vapor pressure and moisture content in an atmosphere over acid of varying strengths and temperatures. It emphasizes the importance of low temperature and indicates the possibilities of sulphuric acid as an industrial drier. The heat due to the latent heat of condensation of the vapor varies from 1,073 B.t.u. at 32 deg. F. to 1,007 B.t.u. at 150 deg. F. plus the heat of dilution, which varies with the dilution limits.

Fig. 2 gives the curves for the heat of dilution as calculated by Thomsen, and Knietsch's determinations, which are considerably higher. They indicate that diluting from 60 to 50 deg. Bé. each pound of water

‡*Amer. J. Sci.*, vol. 30, p. 441 (1885).

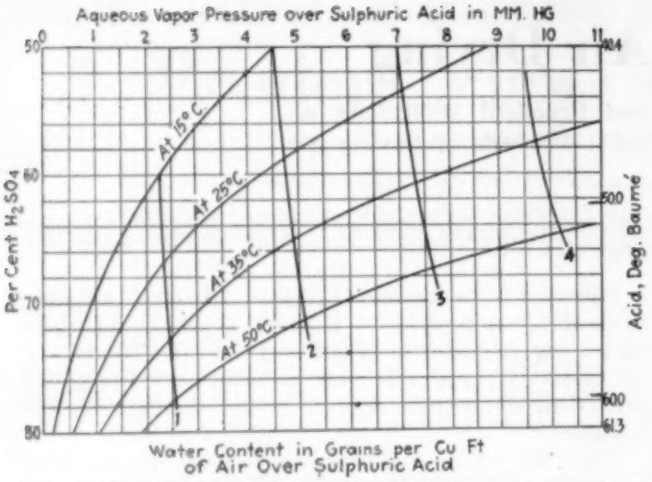

Aqueous Vapor Pressure over Sulphuric Acid in MM. HG
Per Cent H_2SO_4
Acid, Deg. Baumé
At 15°C.
At 25°C.
At 35°C.
At 50°C.
Water Content in Grains per Cu Ft of Air Over Sulphuric Acid

FIG. 1—VAPOR PRESSURE AND MOISTURE CONTENT IN AN ATMOSPHERE OVER ACID OF VARYING STRENGTHS AND TEMPERATURES

evolves 480 B.t.u., according to Knietsch's higher values. Each pound of water absorbed will dilute 4 lb. of 60 deg. Bé. acid to 50 deg. Bé. From these data both the acid and cooling requirements can be determined, and it is evident that drying on a commercial scale to from 1 to 2 grains per cubic foot is practicable.

The difficulties above noted have proved serious enough, however, to prevent any wide application of the sulphuric acid method of vapor absorption even in the vacuum process of ice manufacture where the conditions are favorable.

II—Drying by Compression

Compression followed by cooling and condensation produces a compressed air saturated, if enough moisture be present, to the dew point at the temperature of the air receiver or condenser, any excess of moisture present being condensed and settled out in the receiver. Upon isothermal re-expansion to atmospheric pressure, the percentage saturation due to the remaining vapor will be equal to 100 divided by the number of atmospheres absolute pressure at the condenser.

In Fig. 3 the curve *A* shows the moisture content per cubic foot of free air after drying by compression to the pressures indicated, cooling to 70 deg. F. and removing the condensate. The curves *B* and *B'* give the horsepower developed in single- and two-stage compressors respectively per 1,000 cu.ft. of air per minute when compressing to the pressures shown. Curves *C* and *C'* give the power developed in single- and two-stage compressors respectively in removing 1 lb. of water per minute from air saturated at 70 deg. F. If the air is originally saturated only to 70 per cent, the first half atmosphere of compression will be above dew point and a much larger volume of air is compressed per pound of water removed and in that case over 200 hp. is developed per pound of water removed per minute at one atmosphere pressure and 276 hp. per pound of water removed per minute when reducing the residual moisture to one grain per cubic foot.

It is evident that drying by compression is fairly effective at high pressures with low-temperature condensers of ample size to prevent entrainment of mist, but it is also apparent that the cost of drying by compression would be prohibitive unless such compression is incidental to some other process.

In Fig. 4 the power and drying conditions are given for high pressures using four-stage compressors. It will be noted that the resultant effluent moisture is about 0.25 grain per cubic foot at 500-lb. compression and that the further removal of moisture is then very gradual with increasing pressures.

In operations such as liquid air or oxygen manufacture where pressures up to 200 atmospheres are used, each cubic foot of compressed air saturated at, say, 70 deg. F. contains 7.98 grains of moisture, but this represents 200 cu.ft. of original free air with moisture reduced to 0.039 grain per cu.ft., or 0.49 per cent saturation. The compression and cooling have removed 99.5 per cent of the original moisture. The remaining quantity of moisture would, however, be prohibitive in the liquefying process, as the ice formed would quickly stop the refrigerating coils. The compression condensation which removes most of the moisture must, therefore, be followed by a more efficient desiccating method in order to approach an absolutely anhydrous condition.

III—Drying by Refrigeration

The vapor pressure and therefore quantity in a given volume of saturated air varies functionally with its temperature, hence lowering the temperature of air causes condensation of the excess of water in the air at its original temperature over its dew-point content at the lower temperature.

TABLE II

Temp., Deg. F.	Vapor Pressure, In. Hg	Gr. Per Cu.Ft.	Volume Displaced, Per Cent
—40	0.0039	0.072	0.024
—20	0.0126	0.166	0.042
—10	0.0222	0.285	0.074
0	0.0383	0.481	0.128
+10	0.0631	0.776	0.211
20	0.1026	1.235	0.343
30	0.164	1.935	0.548
40	0.247	2.849	0.825
50	0.360	4.076	1.203
60	0.517	5.745	1.728
70	0.732	7.980	2.446
80	1.022	10.934	3.416
90	1.408	14.790	4.706
100	1.916	19.766	6.404
110	2.576	26.112	8.610

For convenient approximations, Table II gives in abridged form the standard psychrometric tables, including the vapor pressure, and weight of water per cubic foot in saturated air and the corresponding volumes of dry air displaced at various temperatures.

Thus if it be desired to refrigerate to a dryness of 2 grains per cubic foot, it is evident we must refrigerate

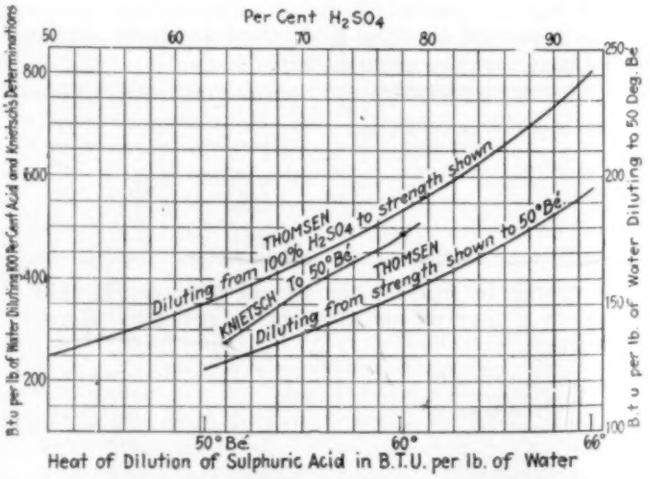

Per Cent H_2SO_4
B t u per lb of Water Diluting 100 Per Cent Acid and Knietsch's Determinations
B t u per lb. of Water Diluting to 50 Deg. Bé
THOMSEN
Diluting from 100% H_2SO_4 to strength shown
KNIETSCH To 50° Bé.
THOMSEN
Diluting from strength shown to 50° Bé.
Heat of Dilution of Sulphuric Acid in B.T.U. per lb. of Water

FIG. 2—HEAT OF DILUTION OF SULPHURIC ACID, AS CALCULATED BY THOMSEN AND BY KNIETSCH

below 31 deg. F., and for 1 grain below 16 deg. F. To determine accurately the total quantity of water to be removed allowance must also be made for the shrinkage in air volume proportional to the change in absolute temperature as given in the last column of Table II.

The power required for refrigeration is best indicated by an example:

The theoretical power required to make a heat transfer from a cool to a warmer body is:

$$\text{Hp.} = \frac{778}{33000} Q \frac{T_1 - T_2}{T_1}$$

in which

Q = B.t.u. refrigeration per minute.
T_1 = Inlet absolute temperature, deg. F.
T_2 = Outlet " " deg. F.

Let it be required to refrigerate 1,000 cu.ft. of air per minute at 65 deg. F. and 70 per cent saturation, or 4.75 grains moisture per cubic foot, to saturated air at 25 deg. F. which contains 1.55 grains per cubic foot.

$$T_1 = 65 + 460 = 525$$
$$T_2 = 25 + 460 = 485$$

The air weighs 75 lb., of which 0.678 lb. is water vapor. The cold air has contracted to 924 cu.ft. containing 0.204 lb. of vapor.

Q = for the air	74.32 lb. × 0.2375 × 40 =	706.1 B.t.u.
+ for vapor	0.678 lb. × 0.45 × 40 =	12.1 B.t.u.
+ for ice	0.678 − 0.204 = 0.474 lb. × (1072 + 144) =	576.4 B.t.u.
	Total =	1294.6 B.t.u.

It is evident from the above components of Q that more than half of the thermal work is consumed in cooling the dry air and less than 45 per cent by the water actually removed.

$$\text{Hp.} = \frac{778}{33000} \times 1295 \frac{40}{525} = 2.33$$

To this must be added the factors for the efficiency of boilers and engines or generators and motors and refrigerating compressors, radiation losses and the power consumed by circulating pumps and fans to move the air through the system.

The most efficient modern ice plants make 16 tons of ice per ton of coal. Based on reducing the water temperature 40 deg. F. in making ice, the process involves the transfer of 4,089 B.t.u. per minute requiring 7.36 hp. per ton of coal per 24 hours. Based on the same efficiency it will require 634 lb. of coal per 24 hours to refrigerate the assumed air current of 1,000 cu.ft. per minute. To this must be added not less than 2 motor horsepower for fans to overcome the air resistance of the system.*

Johnson gives an excellent discussion of refrigeration applied to drying blast in his "Blast-Furnace Construction," in which he concludes, by entropy diagram calculations, that to refrigerate 1,000 cu.ft. of air per minute from 85 deg. F. and 70 per cent saturation to 25 deg. F., with condenser temperature at 85 deg. F. will require:

With single-stage refrigeration	11.56 hp.
With two-stage refrigeration	7.95 hp.
With two-stage refrigeration and regeneration	4.97 hp.

Each refinement adds to the first cost of the plant, and the elaborate regenerating towers required in the last scheme would also add seriously to the power required to blow the air blast through the system, so that the ultimate relative economy is not what it appears from the above figures.

As the temperature of refrigeration is lowered the value of $\frac{T_1 - T_2}{T_1}$ and therefore the power required rapidly increases and Johnson's curve gives the follow-

*In his dry blast at the Isabella furnace Mr. Gayley allowed 75 hp. for circulating fans and brine pumps when the blast was 34,000 cu.ft. per minute.

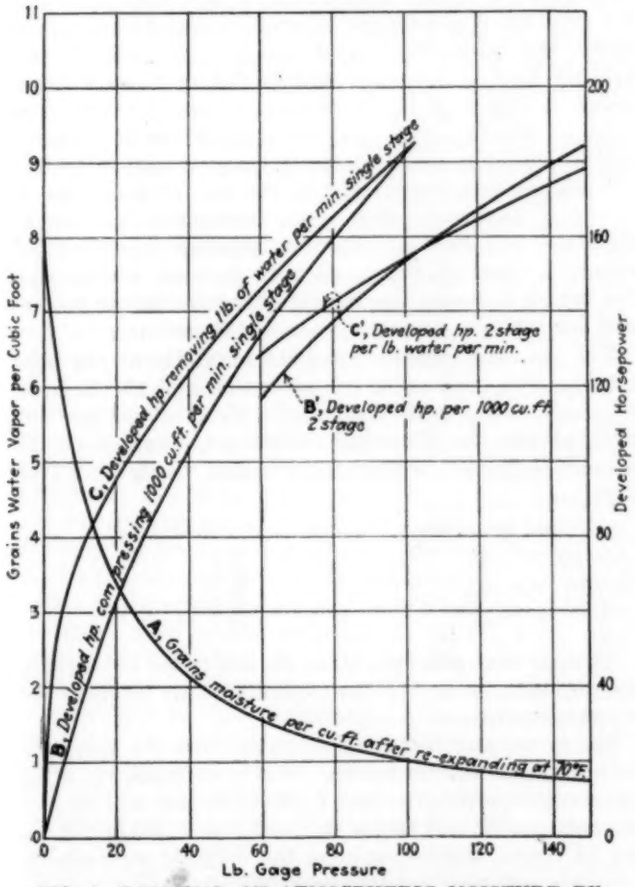

Grains Water Vapor per Cubic Foot
Developed Horsepower
Lb. Gage Pressure
C, Developed hp. removing 1 lb. of water per min. single stage
C, Developed hp. compressing 1000 cu. ft. per min. single stage
B, Developed hp. per 1000 cu. ft. 2 stage
C', Developed hp. 2 stage per lb. water per min.
B', Developed hp. per 1000 cu. ft. 2 stage
A, Grains moisture per cu. ft. after re-expanding at 70°F.

FIG. 3—REMOVAL OF ATMOSPHERIC MOISTURE BY COMPRESSION WITH CONDENSER AT 70 DEG. F.

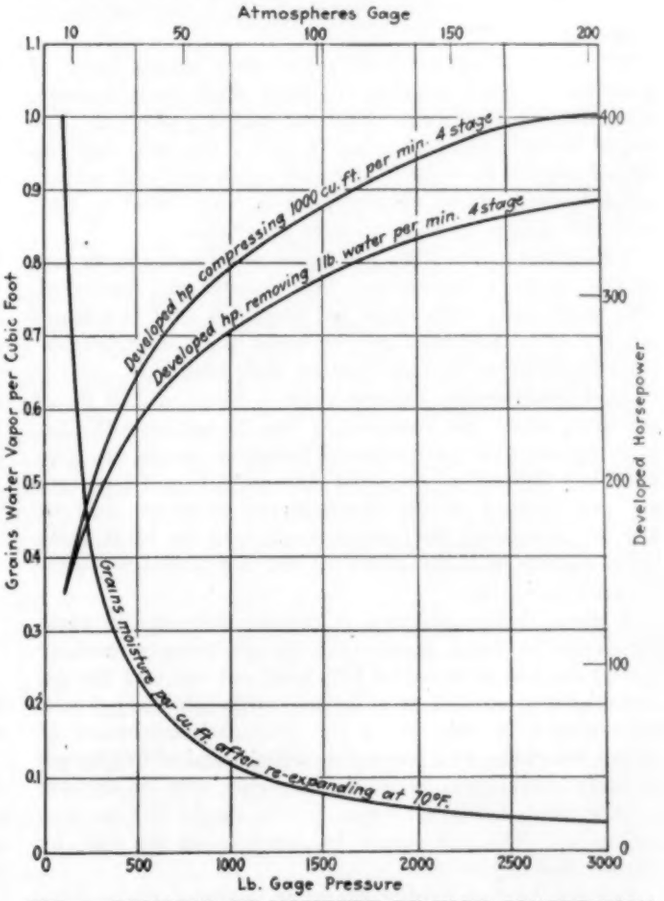

Atmospheres Gage
Grains Water Vapor per Cubic Foot
Developed Horsepower
Lb. Gage Pressure
Developed hp compressing 1000 cu. ft. per min. 4 stage
Developed hp. removing 1 lb. water per min. 4 stage
Grains moisture per cu. ft. after re-expanding at 70°F.

FIG. 4—REMOVAL OF MOISTURE BY HIGH COMPRESSION WITH CONDENSER AT 70 DEG. F.

ing figures for the horsepower required per pound of water removed per minute in refrigerating air below 40 deg. F. by direct expansion, single-stage refrigerator with condenser temperature at 70 deg. F.

	Hp.		Hp.
At 40 deg. F.	6	At 20 deg. F.	24
32 deg. F.	10	15 deg. F.	35
30 deg. F.	12	10 deg. F.	50
25 deg. F.	17	5 deg. F.	68

The same relative increase in power consumption would apply also to the more economic type plants, and it is evident that the economic limit of refrigerating temperature and resulting dryness is soon reached because of the rapid increment in power required with each degree drop.

IV—Drying by Adsorption

Adsorbents are bodies having ultra-microscopically porous structures which possess such intense capillarity that they will selectively adsorb and condense within their pores vapors from air or other gases under conditions of temperature and pressure above the normal liquefying points of the vapors, the action being selective in inverse order to the vapor pressures. The action is purely mechanical, although it results in the separation of chemicals when vapors of different tensions are present, and the adsorbed vapors can be recovered in concentrated form from the adsorbent by the application of heat.

Natural substances such as clay, fullers earth, bauxite, alumina, charcoal, etc., when properly activated have this property in varying degrees, but as the pore structure and effective capacities of natural substances are widely variable, they do not meet the exacting requirements of uniform pore size, high capacity, durability and ease of reactivation necessary in most commercial processes.

Silica gel is an artificially prepared porous form of pure silica which appears to fulfill these requirements. It is made in different types for varying service. For water vapor adsorption the "type C" gel will take up 30 per cent of its weight of water vapor and still remain sensibly dry. After saturation it is reactivated by heat without change in its structure or efficiency.

Vapor pressures over activated adsorbents have not, to the writer's knowledge, been accurately measured. The work done with silica gel indicates that the vapor tension over activated gel is lower than over concentrated sulphuric acid and higher than over P_2O_5.

In a compression oxygen plant a filter of 175 lb. of granular silica gel running to the "break point" (i.e., until appreciable quantities of moisture escape the gel) ran over 200 hours on a net flow of 120 cu.ft. of free air per minute at 50 atmospheres pressure and 68 deg. F., as against the normal practice of the plant using lump caustic potash, when it did not average better than 50 hours run.

A more severe test was a 5-hour run on the same air stream as above, except that the preliminary washing towers for the removal of CO_2 were cut out and the gel adsorbed CO_2 as well as moisture, although the gel cells were within 20 deg. F. of the critical temperature of carbon dioxide. The possibility of removal of CO_2 by gel by slight refrigeration of the adsorber cells to develop a little more surface tension in the liquid CO_2 is thus indicated. The gel would be reactivated for CO_2 by simple decompression.

For the partial drying of large volumes where it is allowable to leave 0.1 grain or more of moisture in each cubic foot, silica gel is used in pulverized form in a counter-current series of applications in order to economize on the quantity of gel and of activating heat required. Vapor equilibrium is obtained almost instantly when proper contact is assured, as the total time of air-gel contact in a three-stage laboratory size plant is less than one second.

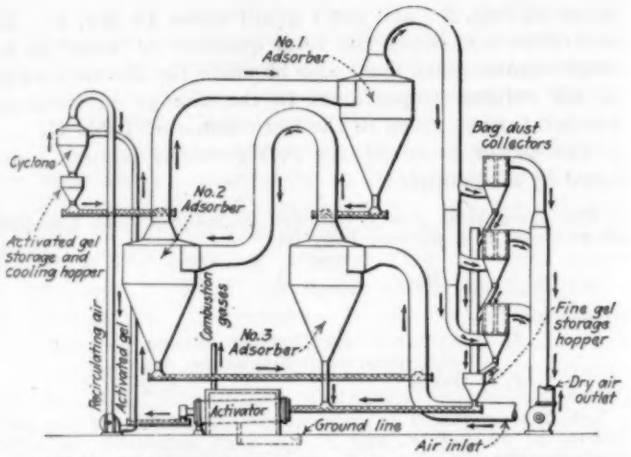


FIG. 5—DIAGRAMMATIC LAYOUT OF A CONTINUOUS THREE-STAGE COUNTER-CURRENT GEL ADSORPTION PLANT

Fig. 5 is a diagrammatic layout of a continuous three-stage counter-current gel adsorption plant such as is used for large volume air drying down to 5 per cent humidity or over. The active gel is fed into the inlet of adsorber No. 1, where it gives the air, which has already been twice treated, its final drying. The slightly saturated gel is then dropped out of adsorber No. 1 and fed into No. 2 and thence into No. 3 adsorber, where it meets the untreated humid air and receives its saturating load of moisture and is fed to the activator, which is either of the horizontal rotary indirect drier type as shown, or a multiple hearth turret furnace which is used to advantage for fractional activation. The air passing counter-current to the gel through Nos. 3, 2 and 1 adsorbers then goes through a battery of standard bag dust collectors to remove traces of gel escaping adsorber No. 1 and then through a multivane fan which balances the resistance of the whole system and delivers the dried air at a slight pressure.

The gel ratio depends upon the humidity of the inlet air, the temperature of the operation and the dryness required. Thus with a ratio of 0.75 lb. of gel per 100 cu.ft. of air, the following results are obtained at the respective outlet temperatures given using the type C gel:

Outlet Temp., Deg. F.	Per Cent of Total Moisture Removed
80	92.6
85	86.6
90	82.0
95	78.6
100	75.5
105	72.9

The per cent adsorption can be controlled by varying the gel ratio, or by the use of cooling coils to lower the outlet temperature.

The power and heat required to perform the operation vary with the duty required. In a large installation the gross requirements for each 1,000 cu.ft. per minute flow are between 70 and 90 kw.-hr. and 3 to 5,500,000 B.t.u. per 24 hours, depending upon the original atmospheric humidity and the final dryness required.

What Is the Life of Silica Gel?

Experimental Results Show Possibility of Repeated Activation of the Gel After Adsorption*

VARIOUS gases have been recovered in the past by the use of silica gel. The process for the manufacture of phosgene may be cited as an example of this. In this process, a mixture of phosgene and nitrogen is obtained and the phosgene is recovered by passing the mixture through silica gel at 0 deg. C., whereby phosgene is adsorbed by the gel and the nitrogen allowed to pass through. The phosgene is then driven out by heat and condensed. Silica gel has also been used in small-scale plants for the adsorption of nitrogen peroxide. Because of its increasing use as an adsorption medium for gases, quite extensive tests have been carried out on this substance, with very interesting results. The object of these tests was primarly to find out how many times the gel could be used successively without diminishing its adsorptive power. Series of runs were made with water, benzene, nitrogen peroxide and nitric acid, respectively.

Simple Apparatus Used for Water Series

In conducting the test with water, the apparatus consisted of a flow meter, a sulphuric acid drier and containers for the water and the gel. The silica gel used was 8 to 14 mesh, made by the Davison Chemical Co.

To activate the gel the glass tube containing it was fitted into a malleable iron pipe, with suitable connections for the passage of air. This was heated to a temperature of 200 deg. C., while a slow current of dry air was passed through to remove the adsorbed material. The condensed vapors were collected and weighed.

Air bubbled through water at 20 to 25 deg. C., thereby humidified to a uniform degree, was then passed through the activated gel in the tube. This vapor was passed through at a uniform rate, until the saturation point was reached. In most cases the time required was from 12 to 15 hours. Having reached this saturation point, the tube was weighed, then reactivated and weighed again. Results obtained appear in Table I.

These data show that the amount of water adsorbed drops off slightly, being 9.3 per cent of the weight of the silica gel for the first fourteen runs and 15.9 per cent for the last fourteen runs. Considering the occurrence of experimental errors in these runs, it is probable that extremely high figures obtained in runs 2, 7 and 13 were in error. Omitting these values, the average adsorption for the remaining eleven runs was 18.5 per cent. The gel itself showed no evidence of disintegration and was apparently in as good condition after the last run as it was at the beginning of the series.

On benzene runs made with the same lot of silica gel as in the runs on water, but with the flow of air through the apparatus lowered somewhat, it was found possible to saturate the gel in 4 to 5 hours, keeping the benzene at room temperature (20 to 25 deg. C.). The results shown in Table II point out the fact that the adsorption in the first forty runs (17.45 per cent) was somewhat higher than that obtained in the remaining forty-three runs (16.35 per cent). The gel was apparently as good at the end as at the beginning.

To obtain satisfactory adsorption with nitrogen peroxide, it was necessary to pack the tube and the nitrogen peroxide container in ice. The gas was allowed to pass through the gel until the nitrogen-peroxide vapors could be seen issuing from the top of the tube. The length of time required for this varied from 2 to 3 hours. Since silica gel was used at Edgewood Arsenal to adsorb nitrogen peroxide during its manufacture there, particular interest was attached to the determination of the life of silica gel when used on this material. The results shown in Table III show a variation in the amount of nitrogen peroxide adsorbed from 60 to 68 per cent of the weight of silica gel used. The average of all runs was 63.86 per cent. The variations shown are probably caused by experimental error. The gel apparently had not deteriorated in any respect at the end of these runs, and it was apparent that its power of adsorption was equally as high at the end as at the beginning. Because of the fact that the gas used was impure it was thought advisable to follow the nitrogen-peroxide run with nitric acid.

These runs were made in the same general manner as in the case of the NO_2. Commercial 70 per cent HNO_3 was used in this series. The temperature employed in carrying out this test was from 20 to 25 deg. C. It was found necessary to run the air through the gel at the rate of 1,000 cc. per minute, over a period of about 16 hours, for the gel to reach the saturation point. Tabulated results of the experiments appear in Table IV.

TABLE I.

Run No.	Wt. of Gel Before Adsorption, G.	Wt. of Gel After Adsorption, G.	Amt. H_2O Adsorbed G.	Amt. H_2O Adsorbed Per Cent	Water Expelled On Activation G.	Water Expelled On Activation Per Cent
1–14	206.0	245.7	39.7	19.3	40.0	100.6
15–28	203.2	238.3	35.2	17.3	35.3	100.0
29–42	204.3	238.1	33.6	16.4	33.5	99.5
43–56	205.6	238.0	32.6	15.9	35.3	100.0
1–56	204.8	240.0	35.3	17.2	36.0	100.0

TABLE II.

Run No.	Wt. of Gel Before Adsorption G.	Wt. of Gel After Adsorption, G.	Amt. C_6H_6 Adsorbed G.	Amt. C_6H_6 Adsorbed Per Cent	Benzene Expelled On Activation G.	Benzene Expelled On Activation Per Cent
1–20	210.0	246.5	36.5	17.5	36.6	100.4
21–40	208.9	245.1	36.2	17.4	36.1	99.7
41–60	210.5	244.9	34.4	16.4	34.2	100.1
61–83	210.2	244.4	34.2	16.3	34.3	100.4
1–83	209.8	245.2	35.3	16.8	30.3	100.2

TABLE III.

Run No.	Wt. of Gel Before Adsorption, G.	Wt. of Gel After Adsorption, G.	Amt. NO_2 Adsorbed G.	Amt. NO_2 Adsorbed Per Cent	NO_2 Expelled On Activation G.	NO_2 Expelled On Activation Per Cent
1–15	39.21	63.70	24.52	62.60	24.48	99.8
16–30	39.94	63.85	24.04	60.20	24.03	99.7
31–45	39.28	64.92	24.65	65.27	25.68	100.0
46–63	38.69	64.52	25.84	66.80	25.87	100.0
1–63	39.22	64.26	25.05	63.86	25.05	99.9

TABLE IV.

Run No.	Wt. of Gel Before Adsorption, G.	Wt. of Gel After Adsorption, G.	Wt. HNO_3 Adsorbed G.	Wt. HNO_3 Adsorbed Per Cent	Wt. HNO_3 Expelled By Activation G.	Wt. HNO_3 Expelled By Activation Per Cent
1	24.35	40.87	16.52	67.8	16.51	99.0
1–5	24.28	39.43	15.10	62.0	14.91	100.0
6–10	24.31	38.47	14.18	58.3	14.39	100.0
11–15	24.16	38.64	14.49	59.9	14.51	100.2
16–19	24.17	37.98	13.82	57.6	13.81	99.9
1–19	24.25	38.67	14.42	59.6	14.38	100.0

*Abstract of a report on work done in the research laboratories of the U. S. Chemical Warfare Service at Edgewood Arsenal. This work, done by E. M. Faber and H. G. Olson, was supervised by W. A. Taylor, chief of the organic department.

Easier Reading Mercury Thermometers

While mercury thermometers are necessary from the standpoint of accuracy, fault has been found because they are read with difficulty. The C. J. Tagliabue Co. is marketing a new type of tube which corrects this fault by showing a broad red band from the top of the mercury column to the top of the tube.

Production of Synthetic Vanillin By the Ozone Process

Design, Construction and Operation of Equipment for Commercial Manufacture by a Method Which Appears to Hold Many Interesting Possibilities

By Burton G. Wood
Chemical Engineer, Los Angeles, Calif.

THE OXIDATION of isoeugenol to vanillin by means of ozone takes place rapidly at ordinary temperatures. In fact the reaction is so rapid that it must be retarded or an undesirably large amount of resin will be formed. The process is subject to a basic patent[1] in this country, but it is doubtful if any yield could be obtained if the process therein described were followed literally.

In 1904 the Ozone Vanillin Co. was formed in this country for the purpose of manufacturing synthetic vanillin by the ozone process. The company was equipped with a wide variety of expensive equipment. However, the plant never attained efficient production and was abandoned when, seemingly, on the very point of success.

In a previous article in this magazine (vol. 28, No. 9, p. 399, Feb. 28, 1923) Mr. Wood outlined the properties of synthetic vanillin and discussed in a general way the various processes that have been proposed for its manufacture. He points out that the chief commercial methods depend upon the oxidation of isoeugenol, a product obtained from clove oil. Although the ozone process described in this article is not at present in commercial operation in the United States, it is the belief of the editors that the interesting discussion points out a number of very promising possibilities.

The general plan of the process is shown in Fig. 1. The ozonized air is drawn through the isoeugenol rather than being blown through it, because of the difficulty in designing an ozone machine that would withstand the pressure. The blower cannot be placed between the ozone room and the oxidizing tower, because the ozone will attack the impellers of the blower and cause a loss of ozone as well as rusting the blower unless it is kept well coated with oil. Another reason for drawing rather than blowing the air is that the tower top is likely to open up with a slight inside pressure, while a slight suction will tend to keep it tight. Accordingly the best place for the blower is at the final end of the apparatus, making it act as a vacuum pump or so-called negative blower.

The ozone room should preferably be separated from the rest of the plant. A room 10x20ft. is large enough to accommodate eight machines of 4 kva. capacity each, or capable of using 32 kva. One air-cooled transformer of 4 kva. is placed under each ozone machine. In case one machine is out of commission, it is not necessary to close down all of them, or if this machine be temporarily disconnected, the transformer does not become inefficient due to partial load, as would be the case if only one large transformer were used. Ventilation should be made at the top of the room. In fact, it is well to have an ordinary exhausting fan to keep the air circulating and the room free from ozone, particularly if it is necessary to have a man working around one of the machines. The breathing of ozone even for a short time is very painful.

The generation of ozone is one of the first difficulties met in this process. Many of the patented machines designed for laboratory use fail to give satisfactory results when used on the large scale demanded by this process. The writer, after experimenting with a number of standard type machines, finally evolved a commercial-sized unit that gave excellent results. On the large machine using plates 22 in. square it was found possible to maintain a yield of 65 grains of ozone per kva. when drawing air across the plate at the rate of 3 cu.ft. per plate per minute. Precautions were taken to prevent the formation of any salts on the face of the plate. Each machine was built to use 4 kva. of power with a tension of 9,000 volts. The maximum yield obtained with this machine was 3 oz. of vanillin per kva.

The ozonized air is carried from the ozone room to the oxidation apparatus in a 3-in. pipe, which is an ordinary iron pipe lined with a shellac coating. All turns in the lines are made with tees and the idle end of the tee fitted with a 1-in. valve. The 3-in. line runs to the bottom of tower 1 (see Fig. 1). This tower is made of 24-in. sewer pipe set on a cement foundation. Its height is 18 ft. A 1½-in. outlet pipe is set in the base. The tower is partly filled with splash plates or balls that will break the flow of the air. It is desirable, of course, to get all of the ozone from the air, and this is not an easy task. Between tower 1 and tower 2 there is a check valve. The second tower is exactly the same as the first one; the pipe between the two towers runs from the top of the first to the bottom of the second one. Tower 3 is made of the same size pipe as the other towers, but is only 8 ft. high. This tower is also filled with packing except at the lower section. A small bronze circulating pump lifts the material from the bottom to the top of this tower. The pipe between tower 2 and tower 3 runs from the top of the second

[1] U. S. Pat. 553,039.

tower to within 2 ft. of the bottom of the third. The last tower is made of iron and filled to within 2 ft. of the bottom with iron splash plate or old iron fitting. This tower is also equipped with a small circulating pump. The pipe from tower 3 to tower 4 runs from the bottom of tower 3 to within 2 ft. of the bottom of the fourth tower. The blower is connected to the top of tower 4, and there is a 3-in. relief valve between the tower and the blower. The valve is always opened just before the blower is shut down. The blower should best be belt driven, so that if a line should become clogged, the belt will slip off, thus giving relief to the system and at the same time indicating trouble. The top of each tower should be air tight. This can be accomplished by putting a 2-in. plank cover in the top and then packing the joints with cotton and finally coating them with water glass.

Operating Procedure

The operation of this apparatus is carried out as follows: Tower 1 is filled with 150 lb. of isoeugenol and 100 lb. of sodium bisulphite (40 per cent) solution. Tower 2 is filled with 100 lb. of isoeugenol and 75 lb. of the bisulphite solution. Tower 3 is charged with 40 gal. of 10 per cent sodium carbonate solution. Into tower 4 is poured 40 gal. of 10 per cent sodium hydroxide solution. As previously explained, the function of towers 1 and 2 is to take the ozone from the air. As soon as the ozonized air comes in contact with the isoeugenol, the latter is oxidized to vanillin and the vanillin enters into combination with the sodium bisulphite and passes from the reaction sphere. As the ozonized air passes through towers 1 and 2, some sulphur dioxide is given off and collected by the air. The sulphur dioxide is absorbed in tower 3 and in turn carbon dioxide is given off. The air then passes to tower 4 and the isoeugenol vapor and carbon dioxide are removed by the sodium hydroxide. The air, then free from ozone, isoeugenol, sulphur dioxide and carbon dioxide, is discharged through the blower.

Tower 1 contains the largest amount of absorbed vanillin, tower 2 the next amount, and a considerably smaller quantity will be found in towers 3 and 4. To towers 1 and 2 every hour there is added a certain amount of 25 per cent sodium bisulphite solution. Furthermore, the rapid passage of the air causes a large

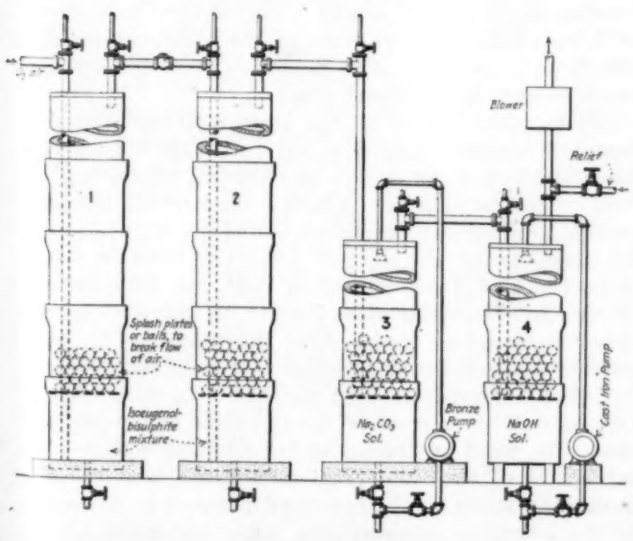


FIG. 1—APPARATUS FOR ISOEUGENOL OXIDATION BY OZONE PROCESS

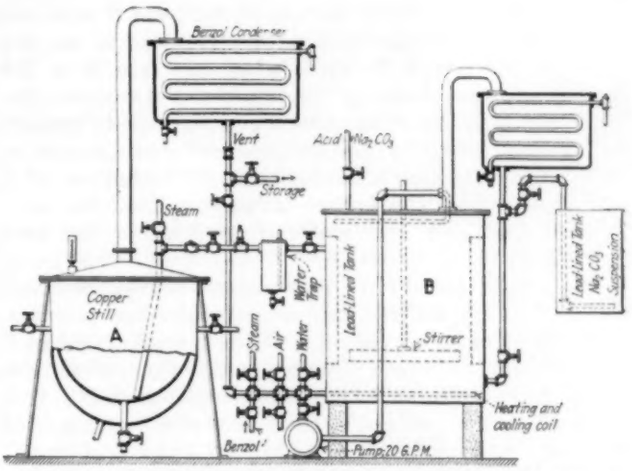


FIG. 2—DECOMPOSITION AND EXTRACTION APPARATUS

loss of water from the towers which must be replaced from time to time. Unless this is done, the bottom of the towers will become clogged with crystals of sodium sulphite.

It is essential that the sodium bisulphite and vanillin react immediately after the latter is formed from the isoeugenol. Otherwise the vanillin will be turned to resin and lost.

After 8 hours of running, the apparatus is shut down and the bisulphite and oil will separate from each other. The bisulphite liquid is then drawn into the decomposer and extractor shown in Fig. 2.

Extraction of the Vanillin

The decomposer and extractor consists essentially of two parts, the still *A* and the lead-lined decomposing tank *B*. The bisulphite liquid is drawn into tank *B*, which is provided with a stirring apparatus. The charge is measured and a sample titrated against Congo red, in order to determine the amount of sulphuric acid necessary to decompose the bisulphite compound and the remaining bisulphite. It is necessary to heat the liquid to 80 deg. C. to insure complete decomposition of the vanillin-bisulphite compound and at the same time to expel all of the sulphur dioxide. The stirrer is then started and 30 per cent sulphuric acid is admitted slowly through a top opening until the required quantity has been added. Heating is accomplished by a coil or a booster of live steam may be used. As soon as the temperature of the liquid reaches 80 deg. C., the sulphur dioxide begins to come off. This is absorbed in a suspension of sodium carbonate or a saturated solution of this salt. After the sulphur dioxide is about all expelled, air is blown through the solution to remove last traces.

After this point it is necessary to make sure that the liquid is slightly alkaline, and for this purpose it is titrated with sodium carbonate solution. Any sulphuric acid present materially affects the color of the product, for there is always some trace of isoeugenol, which chars in the presence of sulphuric acid, especially under heat in the still.

As soon as the sodium carbonate has been added, the water is turned on in the cooling coil and the temperature is brought down to below 75 deg. C. Benzol is then admitted till it overflows into the water trap. The alkaline vanillin solution is now pumped from the bottom of the tank and sprayed on the benzol. As soon as the water shows only traces of vanillin, more benzol

is admitted through the bottom of the tank *B* until the copper still *A* is about half filled. The still is run for a while, the benzol distilled being run into *B* at the bottom and thus washing the liquid free from vanillin. When the liquid in *B* has been exhausted of its vanillin content, the benzol is bypassed and run into a receiving tank. Water is now admitted through the bottom of *B* and thus all of the benzol is washed into the still. Toward the end the water trap has to be used frequently.

The crude vanillin is now drawn into a receiver, where it is crystallized into a very light brown mass. It smells strongly of the oil. The extracted liquid in *B* is then run to waste. When the sodium bisulphite liquid in the absorber has reached proper strength, it is returned to the process, in this way avoiding much of the loss.

Preliminary and Final Crystallizations

The crude vanillin is dissolved in a wood lead-lined tank in fifteen parts of hot water containing about 5 per cent of a filterchar. After boiling for about 5 minutes the mass is pumped through an aluminum filter using a rotary pump capable of operating at 60 lb. pressure at a rate of 20 gal. per minute. The mass is pumped into an aluminum crystallizer. The product from the second crystallization is very much improved in both odor and color. It has only a slight yellow color and practically no odor except when heated on the point of a knife. The water from the second crystallization is used as dissolving water for the first. The first two crystallizations may be made with ordinary water, but the third and last should be made with distilled water absolutely free from iron.

In this final crystallization the water is heated to 90 deg. C., and the vanillin is added while stirring. The stirrer should not have a speed of over 10 to 12 r.p.m. As soon as the vanillin is all dissolved, the stirrer is stopped and the solution allowed to cool very slowly until the first needles are well formed. The stirrer is then started and the cooling hastened by the use of cooling water in the outside jacket. Continuous stirring from the time the crystals are dissolved will produce flat plates rather than desired needle crystals. The melting point and other qualities will be the same as the needle crystals. However, the trade seems to have the idea that vanillin crystals must be needle shaped. If there is a trace of iron in the water, it will give the vanillin a slight yellow color, which shows up especially on being dried. When thoroughly dry, vanillin has a melting point of about 83 deg. C., although a small amount of moisture, 2 to 4 per cent, will lower the melting point to 81 to 82 deg. C.

Magnesite Production Increases in 1922

The production of crude magnesite in the United States in 1922 was 32 per cent greater than 1921. It amounted to 63,487 short tons, valued at $650,742, according to figures compiled by J. M. Hill, of the U. S. Geological Survey. Practically all of the magnesite mined in 1922 was obtained from the California deposits, of which the two producing the most were that of the Western Magnesite Co. at Red Mountain and that of the Sierra Magnesite Co. at Porterville.

During 1922 prior to Sept. 22, when the tariff act took effect, the imports amounted to 112,159 tons, valued at $1,750,636, as compared with 42,486 tons, valued at $592,491, for the 12 months of 1921. There were no exports of the crude or calcined magnesite to balance the imports in 1922. The exports of magnesia products such as pipe and boiler covering were valued at $223,686. Of the domestic magnesite used in the year more than 90 per cent was sold in the calcined form, at an average of about $40 per ton. The remainder, sold for chemical uses, brought about $11.50 per ton.

The assurance of good prices upon the passage of the new tariff act greatly stimulated the domestic industry.

"Wood Alcohol" and "Methanol"

Practice of New Nomenclature Gains Headway—Should Cut Down Accidental Poisoning

The National Wood Chemical Association, through the assistance of W. A. Hamor, assistant director of research for the Mellon Institute, has recently issued a clear-cut statement regarding the nomenclature of wood alcohol. This statement, sent out by F. J. Goodfellow, secretary of the association, is as follows:

"Methyl alcohol, or methyl hydroxide, which is commonly known as wood alcohol, is a clear, colorless and poisonous liquid obtained by the distillation of hard wood. In its crude state it is readily identified by a heavy, pungent odor; but, when refined for commercial use, this odor is almost wholly eliminated. Enough odor usually remains, however, to distinguish it from ethyl (grain) alcohol. Wood alcohol, when ingested in any of its grades and in any solution, is dangerously poisonous. However, there is no conclusive evidence that its external application or ordinary exposure to its vapors is injurious. Cases of poisoning among workmen in wood-distillation plants are almost unknown.

"On account of the large number of casualties attributed to drinking liquor containing wood alcohol, the importance of surrounding its use with every precaution to protect human life has attracted attention for many years, and as a result, numerous protective and restrictive measures have been adopted. One of these measures is the proposal to discontinue from usage the name 'wood alcohol' and use the scientific term 'methanol.' This term came into scientific usage as a result of the action of the International Conference of Chemical Nomenclature, which met in Geneva, Switzerland, in April, 1892. One of the resolutions adopted at this conference was as follows: 'The alcohol and phenols will be called after the name of the hydrocarbons from which they are derived, terminating with the suffix ol; as, for example, methanol, ethanol, etc.'

"Soon after that time the term methanol found its way into German textbooks, but until 1920 did not come into favor with the American chemical profession. In that year the late Dr. Charles Baskerville published several articles wherein he advocated a general adoption by chemists of the correct scientific term methanol. Also Dr. E. J. Crane stated in 1922, for the committee of the American Chemical Society on occupational diseases in chemical trades, that the usage of the word methanol was favored, although not required.

"At the present time, in the New Standard Dictionary, as well as in most of the scientific and trade journals, the word methanol is in common usage. The subject is of such universal importance that the suggestion is made to all interested persons to co-operate in the effort to establish the name methanol for the better protection of those who are not educated along chemical lines."

The Steam Accumulator

The Ruths Accumulator, as Used in Europe, Points the Way to Boiler Plant Economies for Users of Process Steam

By Ismar Ginsberg
Consulting Chemical Engineer, New York City

CHEMICAL and metallurgical plants, paper mills, rubber factories and other establishments in which steam is used as such in the manufacturing process, must contend with the problem of variable steam demand and production. The steam plant is generally designed to meet the conditions of maximum steam demand, with the result that during most of its operation it is running below capacity. In these plants, where steam is used in the chemical process, the demand for steam as motive power may be comparatively small, while the consumption of steam in the actual manufacturing process is quite large and at the same time intermittent. It is needless to remark that steam plants that are run below their capacity in this manner do not operate with the highest attainable efficiency.

This condition is accentuated in paper mills perhaps more than in any other kind of plant, and it was therefore to be expected that the solution of the problem should come from the paper industry. One solution lies in the Ruths heat or steam accumulator, an apparatus of comparatively simple construction, which has given very good results in the Swedish paper mills, where it has been used for some time. Dr. Ruths is a Swede, and although the invention is camparatively new, it has already spread to various English plants as well as to those on the Continent. The importance and practical utility of the apparatus is substantiated by no less an authority than Philip T. Dodge, president of the International Paper Co., who in a recent address said that he deemed the Ruths heat accumulator of paramount importance to every paper manufacturer—in fact to every industry where there is large and variable steam consumption. He added that the International Paper Co. was installing one apparatus at once and that the other mills of the company will be so equipped later on.

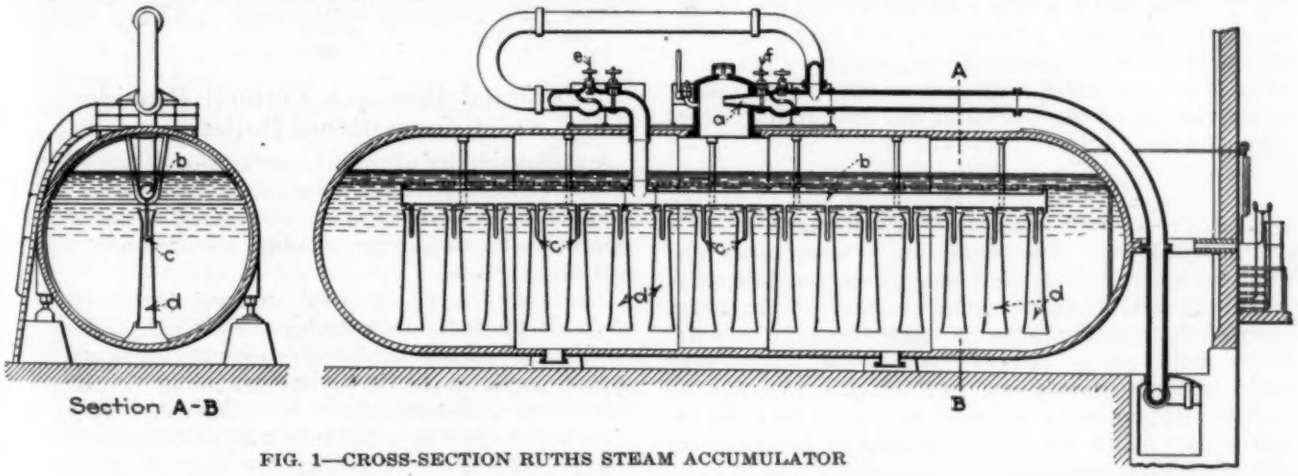


FIG. 1—CROSS-SECTION RUTHS STEAM ACCUMULATOR

The Heat Accumulator in Principle

This heat or steam accumulator is nothing more than a great tank, filled with water to about nine-tenths of its capacity and so thoroughly insulated that it is cold on the outside no matter what the temperature is within. The heat accumulator is connected with the steam line in the plant. When the boiler plant, which is built for minimum capacity when the heat accumulator is used, produces steam in excess of what the plant requires, this excess steam is stored in the heat accumulator. On the other hand, when the plant draws more steam from the boiler plant than it can produce, then the steam that was stored in the heat accumulator in the former case is released and made available for use in the plant. The action is entirely automatic and is accomplished by the difference in pressure on the steam lines actuating double-acting automatic regulating valves. The advantages of a boiler plant which can be operated in this manner, always at its full capacity no matter what the load may be, are great. The apparatus delivers the steam, after storing it for variable lengths of time as the conditions of operation vary, at almost the same pressure at which it was originally produced. In one test the steam was stored for about 3 weeks and practically all of it was recovered from the accumulator, the loss being only 2 per cent.

Absorption and Release of Steam

The steam accumulator is therefore an apparatus that acts like the flywheel in an engine. It stores energy and delivers it when required. It is a hot-water apparatus, the water absorbing the steam under certain conditions and liberating it again at the proper time. If the quantity of water in the heat accumulator is Q kilograms and the quantity of steam that is absorbed is D kilograms, then the total volume after absorption is $Q + D$. If the original heat in the water was q heat units per kilogram and that after absorption is q_1 heat units, then the total heat after absorption $(Q + D)q_1$ is equal to the total heat in the water before absorption Qq plus the heat in the steam, which is DX (X being the heat content in the steam in calories per kilogram). The complete equation will then read, disregarding heat losses, as follows:

$$Qq + DX = (Q + D)q_1.$$

On the other hand, when steam is being removed from the heat accumulator, which of course results in the pressure within the apparatus being diminished, the magnitude of this diminution can be determined from the following equation:

$$Q_1q_1 - D_1X_m = (Q_1 - D_1)q_2.$$

In this equation no account is taken of the losses that take place during cooling. Consequently the symbol X_m

denotes the heat content in the steam leaving the accumulator.

Construction of the Accumulator

The construction of the accumulator may be seen from Fig. 1. The apparatus is made in cylindrical form and is provided with hemispherical ends. The safety nozzle is shown at *a*, and has for its purpose the limiting of the rapidity of the removal of steam, so as to prevent the boiling over of the contents of the accumulator when great quantities of steam are suddenly removed from the apparatus or when a tube breaks. Thus the introduction of water into the outgoing steam pipes is avoided.

The charging arrangement consists of a horizontal distributing pipe *b*, which is located near the water surface and which extends along almost the entire length of the accumulator. To this distributing pipe charging necks or outlets, *c*, are fastened at equidistant points and dimensioned so that equal quantities of steam can stream through all these outlets. The charging outlets are surrounded by tubular casings, *d*, formed to produce diffusion of the steam. These tubular casings extend downward until they almost touch the bottom of the accumulator. This method of charging produces good circulation of the water within the accumulator, so that the maximum difference of temperature noted within the water mass is only 0.2 deg. C. The double-acting valve controlling the charging of the apparatus is seen at *e*, and that controlling the discharge of the apparatus is seen at *f*. The apparatus is also provided with one or two safety valves, an air valve, mud blow-off cocks and the ordinary manholes and hand-holes.

Location of the Apparatus

Fig. 2 shows the location of the accumulator in a typical steam line. The connection is made in parallel with the steam line L_1 in which the steam demand is extremely variable. The connection between the Ruths accumulator and the boiler is made through the automatic double-acting valve *U*, which opens at a very slight pressure rise, a condition which ensues just as soon as the production of steam is greater than the requirement. When the plant is consuming all the steam that the boilers produce, then the valve *U* closes automatically due to drop in pressure on the boiler side of the valve and the total production of the steam plant is rendered available. Furthermore, the steam accumulated in the Ruths apparatus is also allowed to flow into the line L_1 and through the bypass and double-acting valve D_3 into L_2 and L_4 as well.

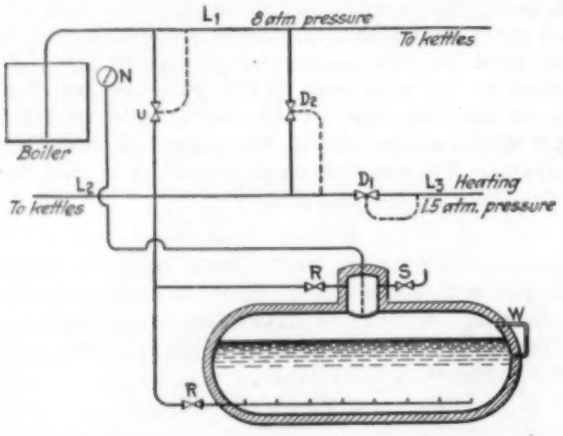


FIG. 2—LOCATION OF STEAM ACCUMULATOR IN STEAM MAIN

There are other methods of arranging this heat accumulator in the piping system of the plant, but this need not concern us here. Each method must fulfill the operating conditions of the plant. Special regulatory devices are provided as well at the power-producing machines and at the overflow valves, which allow the excess steam to flow toward the heat accumulator. All the instruments may be located on a main instrument board, so that the entire operation of the apparatus can be observed and controlled from a single point.

This apparatus has been used in several large paper mills in Sweden and accurate operating data are available on its efficiency. The efficiency of boiler plant operation is considerably increased by installing an accumulator and it is stated that in one Swedish mill the efficiency was increased to 80 per cent and more. The fuel saving has been claimed to vary between 15 and 23 per cent. The largest accumulator is installed in the paper mill of A. B. Kaukas in Wilmanstrand, Finland. The diameter of this apparatus is 5 m., the length 19.5 m. and the capacity 345 cu.m. The accumulator load is 12,000 kg. of steam. The plant operates four B. & W. boilers, each possessing 393 sq.m. of heating surface. Before the accumulator was installed the boiler plant consisted of 20 fire-tube boilers, run by seventy firemen. Now only four firemen are required. The efficiency of the plant is 83 per cent.

National Research Council Provides Informational Bulletins

A useful activity of the Research Information Service of the National Research Council in Washington is the compilation and issuance in convenient form of significant facts concerning scientific research and its industrial relations.

Often the facts assembled to meet the immediate needs of an individual engineer-investigator, firm or association are of sufficiently widespread interest and general value to justify mimeographing, printing or publishing. Informational reports thus prepared by the Information Service ordinarily are available either at cost or free.

Among the compilations which have been made available by Research Information Service or by other divisions or committees of the National Research Council of special interest to engineers are:

Bulletin 3. List of "periodical bibliographies and abstracts of the scientific and technological journals of the world."

Bulletin 9. "Funds available in 1920 in the United States of America for the encouragement of scientific research."

Bulletin 16. "Research laboratories in industrial laboratories in the United States, including consulting research laboratories."

Bulletin 22. "Mechanical aids for the classification of American investigators, with illustrations in the field of psychology."

Reprint 9. "Reading list of scientific and industrial research and the service of the chemist to industry."

Reprint 33. "Informational needs in science and technology."

Reprint 35. "American research chemicals."

Reprint 40. "The usefulness of analytic abstracts."

Several lists of scientific and technological bibliographies also have been issued. Among them are lists of published or unpublished bibliographies of corn and corn products, colloid chemistry, geology and geography, astronomy, mathematics and physics.

Fatigue in Metals*

Theory of Fatigue Demonstrated by Use of Model—Results Predicted by Model Agree With Test Data—Use of This Model to Form Basis of Accurate Strength Calculations and Introduce Fatigue Limits Into Steel Specifications

BY C. F. JENKIN

ABOUT a year ago I was asked to read this paper. About 6 months ago I wrote a paper, knowing that I should be very busy this autumn, and made a model to illustrate a small point in it. But as I played with the model to learn how to use it, it grew too strong for me and took command, and for the last 6 months I have been its obedient slave—for the model explained the whole of my subject—Fatigue. The model destroyed my first paper, and I have been obliged to write a new one in haste, putting it off from day to day as the model taught me new things. The written paper has suffered, but I hope you will find my account of the model more interesting than the tentative theories which filled the old paper. But in any case, I can speak of nothing else.

A simple form of model is shown in Fig. 1. It is made up of three or more "units" fastened together top and bottom. The units are all similar. Each is made up of three pieces—a block *A* with a rod fixed in it, a block *B* sliding freely on the rod, and a block *C* sliding on the rod stiffly, the friction being adjustable. Blocks *B* and *C* are connected by a spring. The model may be constructed in many other ways. The only requirements are (1) that it shall be elastic up to a point and then slip with solid friction; (2) that all the units shall not slip at once as the load on the model is increased. This latter requirement may be met in two ways—either by making the friction different in the different units, or by making the springs of different strengths. The former method is the simpler, and is used in all the models I shall speak of today.

The model may be adjusted so as to have different properties by varying the friction in the different units and also by pushing up or pulling down some of the blocks *C*, so as to give the units initial compression or tension. The model will set itself so that the compression and tension forces will balance.

Let us choose a three-unit model for the first test and give No. 2 unit twice the friction of the two others, and give No. 1 unit a small tension, and No. 3 unit an equal compression, so that the model will still be in equilibrium. Let us imagine that the model is put in a static testing machine with an extensometer attached and tested in tension. At first it stretches elastically, then No. 1 slips, and later No. 3 slips, and finally No. 2 slips. No larger force can be applied. The load-extension diagram given by the extensometer would have the form shown in Fig. 2. This figure is easily constructed. The three lines at 45 deg. are the load-extension lines for the three equal springs. They slope up to the points at which they slip and then are horizontal. The graph for the whole model is found by adding the co-ordinates of all three. If the model were made up of more units, the graph would be less angular. *P* is the limit of proportionality (elastic limit). *YP* is the yield point, *FL* is the fatigue limit. How this is found I shall explain later. Now compare this with Fig. 5, which is a load-strain graph for hardened, but untempered, 225,000-lb. steel.

Next, let us set the model differently. Give No. 2 unit a certain tension and Nos. 1 and 3 a compression of half that amount. The load-strain graph is shown in Fig. 3. Compare this with Fig. 6, which is the load-strain graph for a well-tempered steel.

Next, let us take a model of ten units, and give eight of the units nearly equal friction and the remaining two slightly less. As I pull this model, the weakest unit slips first, then the next. As each slips, more load is thrown on the rest, and when the first of the eight nearly equal units slips, the extra load will cause the next to slip at once, and they will all slip—Jack-run-for-mustard. The graph for this model is shown in Fig. 4. Compare this with Dalby's photographic model for mild steel—Fig. 7.

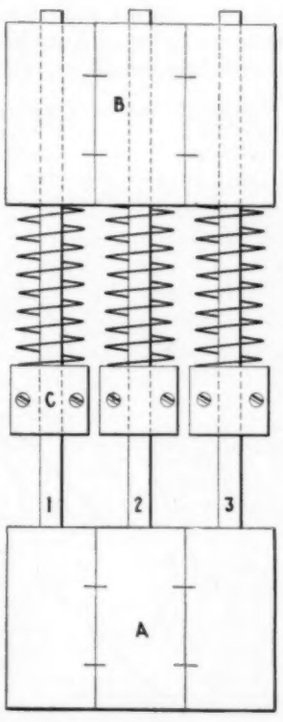


FIG. 1—MODEL REPRESENTING THREE CRYSTALS

In this explanation I have assumed that when the unit slips it becomes weaker, and so throws more load on the rest. I return to this point later.

But there is another very pretty point to notice. Watch the model closely. The units tend to move in little jerks, not quite smoothly, owing to the difference between the static friction and the sliding friction. These little jerks appear in Dalby's photograph of the steel.

If we compress Model No. 2, we shall get the lower curve in Fig. 3. Note that the elastic limits are different in compression and tension. If we carry the test on these models round a cycle we shall get the hysteresis loops shown in Figs. 2 and 3. These have the typical shape of metal hysteresis loops; curved rising lines and straight falling lines. The model will thus represent any of the typical

*Paper read before the Royal Aëronautical Society on Dec. 7, 1922, and reprinted from *The Engineer*, vol. 134, p. 612.

steels very closely—up to the yield point. I have not made it go higher for reasons that I shall explain later.

Now let us see what it does when tested under alternating loads. To start with, apply a large alternating strain to the three-unit model. All the units slip backward and forward, but as the amplitude of the motion is reduced, first one, then another, and finally all the units cease slipping. The amplitude now is the largest which the weakest unit will stand without slipping. The motion is elastic, and, as Bauschinger first stated, the metal will stand this motion indefinitely. We have found the fatigue limit. When the model comes to rest, the units are all stress-free. They are all in what may be called the central position. The fatigue limit points marked *FL* in Figs. 2 and 3 were found in this way.

The truth of Bauschinger's theorem—the identity of elastic range and fatigue range—has been confirmed by Bairstow[1]; also by Gough[2]. Gough invented a test which has turned out to be of the greatest value. A mirror is fixed on the end of the Wöhler test piece and adjusted to run truly in a plane perpendicular to the axis of rotation. The spot of light is reflected by this mirror on to a scale, and as the specimen is loaded this spot moves down the scale. If the deflections are plotted against the load, the graph is a straight line as long as the metal is elastic. Thus the limit of proportionality in Gough's rotating test indicates the fatigue limit. The accuracy of this test has been repeatedly confirmed both by Gough and Lea for many metals. This test gives a method of finding the fatigue limit in a few minutes on a single test piece.

Let Gough's test be applied to a copper test piece. Under static test, copper is not elastic for even the smallest load. The stress-strain curve bends off from the origin without any straight portion. The model representing copper has the maximum possible initial stresses in the units, so that one begins to slip the moment any load is applied. Applying the alternating load to the model, the units will slip into central positions, and we shall find a fatigue range as before. But this test will leave the units in a stress-free condition, and we ought therefore after the test to find the copper elastic. This remarkable result was found experimentally by Gough, and at my suggestion he repeated the test, raising the range gradually first to one-quarter, then to one-half, then to three-quarters of the full range. In this way, the elastic limit of the copper was found to be raised first to one-quarter, then one-half, then to three-quarters of the full range. Thus the experiment exactly confirmed the prophecy based on the model.

The same experiment is now being tried on hardened 225,000-lb. steel. The stress-strain curve—Fig. 5—we have already seen bends off almost from the origin. By applying an alternating stress the steel should be made elastic up to the fatigue limit, according to my theory.

The fatigue limit we have been discussing above is for equal tension and compression loads, but there are infinite series of fatigue limits for unequal loads. How can their magnitudes be found? Suppose that an alternating stress were applied to the model unsymmetrically, so that the tension were greater than the compression. This might be increased till the weakest unit began to slip backward and forward. When that occurred we should have reached the fatigue limits for these particular unequal loads, and the range [or algebraic difference between maximum and minimum load] is the same as before. We may go on making such tests, making the motion more and more unsymmetrical, and the range will remain the same till a new limiting condition intervenes—viz., that the maximum tensile stress must not exceed the ultimate strength of the test piece. This condition reduces the range of stress which can be applied by limiting the magnitude of the larger load. The graph representing the *range* of stress plotted against the *inferior* stress will therefore consist of two straight lines—one horizontal at the range for the weakest unit and the other at 45 deg. through the ultimate strength—see Fig. 9. This graph, according to the textbooks, should be Gerber's parabola—shown in the figure. The model appears to fail here. But compare the graph with the actual results shown in Fig. 8 from Bairstow's paper. The model is clearly right and Gerber wrong.

Before considering further properties of the model,

[1] *Phil. Trans. Roy. Soc.*, vol. 210; see also abstract on p. 820 of this issue.

[2] *The Engineer*, Aug. 12, 1921.

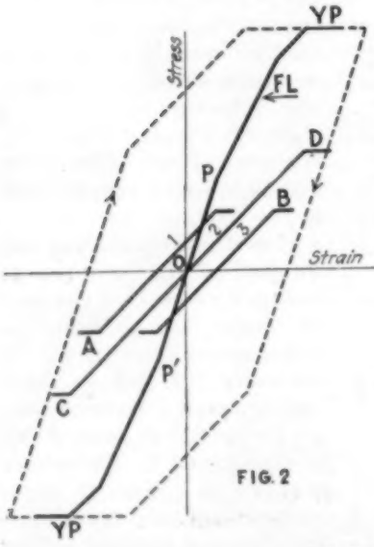


FIG. 2

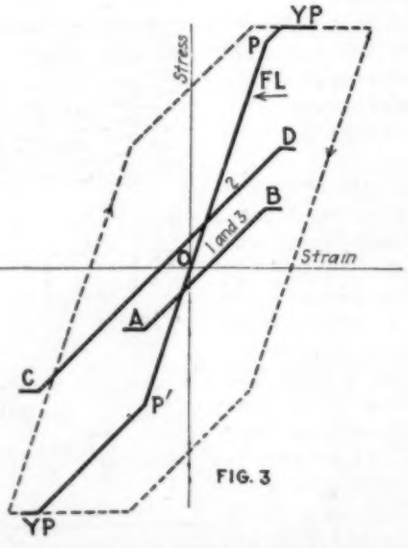


FIG. 3

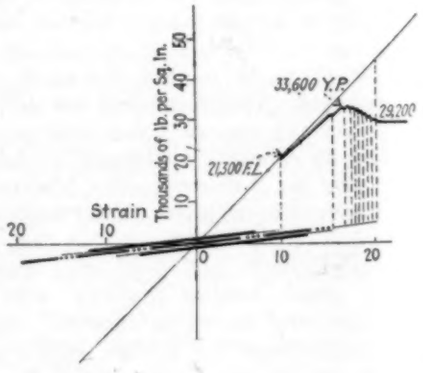


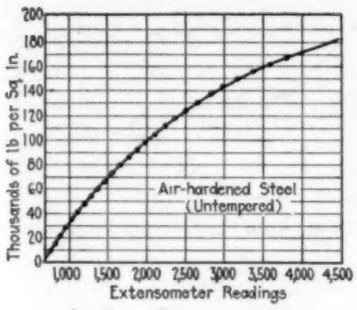
FIG. 4

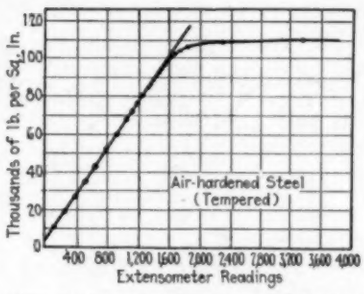
FIGS. 2, 3 AND 4—ELASTIC PROPERTIES SHOWN BY MODEL

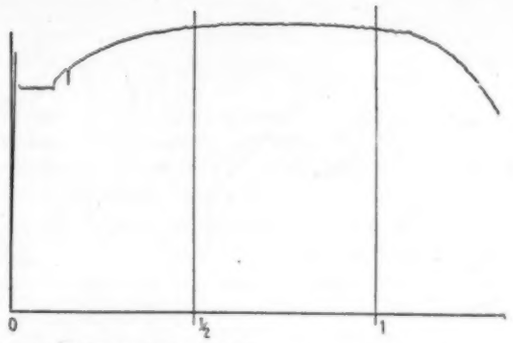
Fig. 2—Crystals of different strength under various internal stresses.

Fig. 3—A few very strong crystals containing large tensions.

Fig. 4—Crystals nearly all of same strength and internal stress.







FIGS. 5, 6 AND 7—STRESS-STRAIN CURVES OF METALLIC TEST PIECES

Fig. 5—Quenched high alloy steel.

Fig. 6—High alloy steel quenched and tempered.

Fig. 7—Mild steel (photographic record by Dalby).

let us see whether there is anything in the metal which can behave as the units in the model behave. The crystals are obviously the units. Ewing and Rosenhain[3] have shown that they are elastic up to a point and then slip along slip planes. They also pointed out that the slip planes lie at all angles with the line of action of the load, so that the resolved shearing stresses along the planes will have all values from a maximum in planes at 45 deg. to zero in planes perpendicular to the load. Thus the crystals will not all slip at once, but one after another. Thus we see that the known properties of the crystals exactly correspond with the assumed properties of the model. Finally, Ewing and Humfrey[4] showed that when slipping backward and forward takes place the slipping surfaces wear, and a crack is ultimately formed, which grows till final fatigue failure occurs. Thus our criterion for the fatigue limit is correct—viz., that we must have no slipping even in the weakest unit.

But if the model represents the metal so accurately, why does it cease to do so at the yield point? The ultimate strength of a metal is much higher, but the ultimate strength of the model is the same as the yield point. It would not be difficult to alter the model to make it imitate the real metal, but the additions necessary for this purpose would not correspond with any reality in the metal. The rise of strength in the metal above the yield point is, I believe, due to the mutual interferences between the crystals. These must have a great effect as soon as there is much distortion—that is, after the yield point. The model and my theory are therefore limited to stresses not exceeding the yield point.

But fatigue is not quite so simple as this. Think of a crystal shearing and then of the two parts slipping backward and forward on each other. We should expect to find that it required a larger force to shear the crystal than to keep it slipping when once it had been sheared. In other words, that the adhesion between the surfaces would be greater than the friction. Experiments show that this is the case. The model can be altered so as to show this difference by making the sliding blocks grip a collar on the rod, off which they slip when the force is greater than the adhesion. How will this modification of the model affect the results we have already got? I have not time to prove it tonight, but you will find that nothing we have so far found is essentially altered till we come to the graph of the complete series of fatigue ranges. Fig. 10 shows the range graph for a five-unit model arranged to represent Bairstow's axle steel allowing for the effect of adhesion. Instead of being horizontal at the top it rises by steps, but these steps may be smoothed out by using more units in the model. Compare this with Bairstow's graph for axle steel—Fig. 8. You will see how closely they agree.

This graph suggested two remarkable experiments. If all the adhesions could be broken down, then the fatigue limit should fall to the value 19.5 tons (44,000 lb. per sq.in.). This can be done by bringing the metal into the "cyclic condition" by overloading it under alternating stress and then gradually reducing the load. All the adhesions are broken down by this treatment, and the crystals are left in the stress-free condition, as we have seen. Tested in this condition, axle steel should have a fatigue limit 25 per cent lower than in the normal condition. I tried this experiment on some 0.33 carbon steel. The fatigue limit was lowered 29 per cent.

The second experiment was even more remarkable. If the steel could be made stress-free, and then have its adhesion

[3] *Phil. Trans. Roy. Soc.*, vol. 193A.
[4] *Phil. Trans. Roy. Soc.*, vol. 200, p. 248.

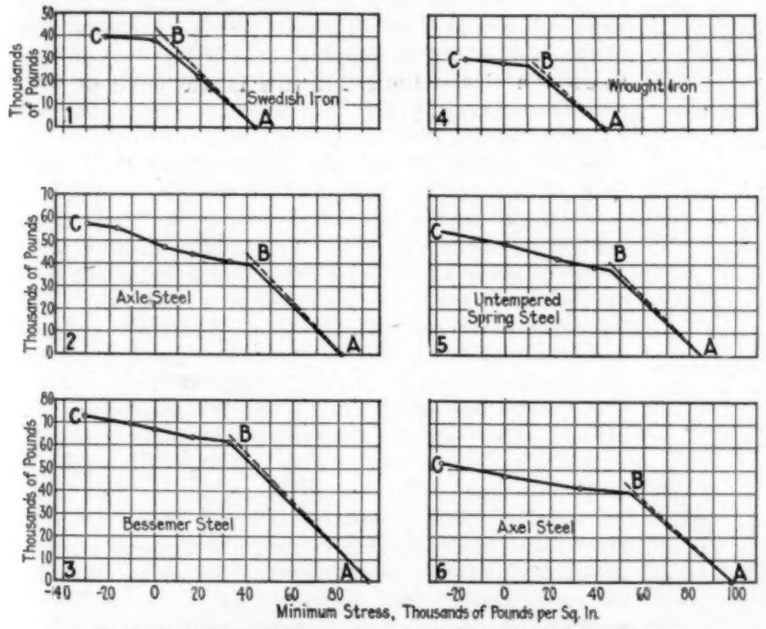


FIG. 8—ELASTIC RANGES BY BAIRSTOW AND SAFE FATIGUE RANGES BY WOHLER IN VARIOUS STEELS

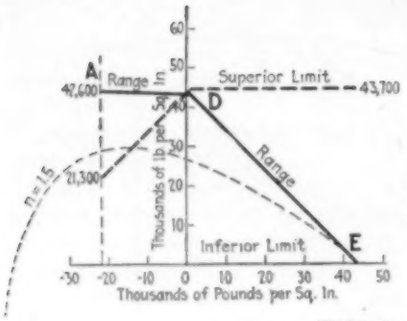


Fig. 9—Swedish iron.

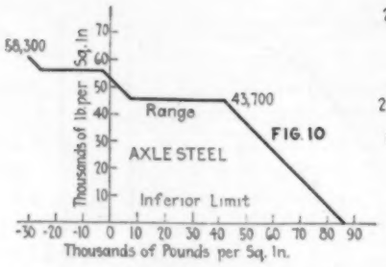


Fig. 10—Axle steel.

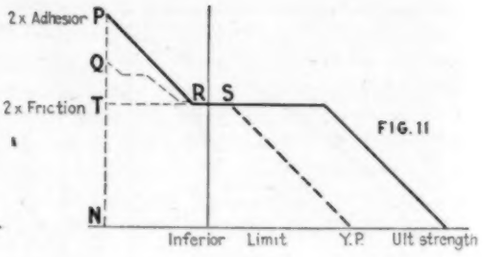


Fig. 11—Abused steel (dotted) and "fatigue hardened" (full line).

FIGS. 9, 10 AND 11—FATIGUE RANGES DERIVED FROM MODELS

restored, the fatigue limit should be raised to the full adhesion value—20 or 30 per cent above the ordinary value. I took the sample which I have just described, which was in the stress-free condition, and boiled it in water for 2 hours. This caused the crystals to heal, and so restored their adhesion. I then tested it, and the fatigue limit was 21 per cent above the original value. These remarkable experiments show that the fatigue limit of steel can have any value between two limits. They are shown in Fig. 11. Finally, these experiments give a direct measure of the ratio of adhesion to friction along crystalline slips, which for the steel tested was 1.7.

Other methods may be employed for raising the fatigue limit. If the metal is very slightly overloaded in the Wöhler test for a few seconds and the load then reduced again, the adhesion of some of the crystals is broken down, but so little damage is done that the sheared faces heal at once and the process can be repeated again and again, each time raising the maximum load a little. Gough, at the National Physical Laboratory, raised the fatigue limit in this way 20 per cent for the steel already referred to, and Professor Lea in Birmingham raised another specimen by rather more.

These experiments show that healing of sheared crystals occurs and that this action may be hastened by very moderate temperatures. Also that the time required for healing depends on the extent to which the slipping faces have been damaged by rubbing. We are thus introduced to a new idea—healing may be taking place during a fatigue test, and the ultimate result (fracture or safety) may depend on a sort of race between slipping and healing. Healing may be thought of as the recrystallization of the minute quantity of metal disarranged by slipping, and it is not difficult to see why this takes place easily and quickly when we remember that the surfaces between which it occurs are parallel arrangements of crystallized material.

If healing produces an appreciable effect, it will raise the fatigue range above the elastic range, and the amount it raises the fatigue range will be greater the more time there is for the action to take place—i.e., the slower the alternations of stress. A second modification of the fatigue range may occur, due to the fact, first demonstrated by Hopkinson, that it takes time for the crystals to slip. Hopkinson showed that for a very short duration of stress, say one-thousandth of a second, metals were elastic far above their ordinary limit. This phenomenon should also raise the fatigue range above the elastic range, but will be most effective at high speeds. These two actions make it necessary to qualify Bauschinger's general statement on the equality of the elastic range and the fatigue range. The magnitude of the two effects is being investigated. It seems probable that healing may be very effective at the temperatures at which some parts of engines—for example, valve springs—work.

The events occurring in the metal undergoing a fatigue test may be examined in other ways. If there is friction between the parts of crystals there must be heat generated, and we can measure this heat by observing the rise of temperature of the metal. This was first done by Hopkinson, and many observers have used the method since. The temperature rise follows closely on the departure from elasticity—i.e., it becomes large when the crystals start slipping. But there is found to be a very small evolution of heat at stresses far below the fatigue limit, and that the heat gradually increases as the load is increased. In other words, there is a small elastic hysteresis. The model does not indicate this elastic hysteresis, and what it is due to is not yet known.

Temperature observations have brought to light some very striking phenomena. When nickel is tested, there occur sudden heat bursts which rapidly disappear again. They recur every time the load is raised. How can these temporary evolutions of heat be explained? Consider the model. If it were stretched and compressed 2,000 times a minute without lubrication, what would happen? The sliding block would "run hot and seize." While it slipped heat would be generated, but the moment it seized the generation of heat would cease. That this may be a true explanation of what happens in nickel is confirmed by two striking facts. If the heat is due to slipping, heat bursts cannot begin below the elastic limit, for this is the point at which the first crystal slips. Experiment shows that they do not. Again, if a sample is tested up to fairly high stresses and all the crystals which slipped have seized, then if the test is repeated on the same sample no heat bursts can occur. This remarkable result is also confirmed by experiment. The trouble is like an infantile illness—a rapid rise of temperature, which a day or two later subsides, and immunity from the illness follows for the rest of one's life. Similar heat bursts occur in hard steel, but they last very much longer and are less pronounced.

In 1915 Prof. F. H. Smith and Mr. Wedgwood published a paper[5] on what they call yield ranges, illustrated with a very large number of figures showing the results of their tests. I have gone through those figures and find that a model consisting of only three units will reproduce them all. Of course, the figures given by the model are very angular, since it has so few units, but that defect could be remedied to any extent by multiplying the number of units.

I am not sure if I have made it clear that the model

[5] *Journal Iron and Steel Institute*, vol. 91.

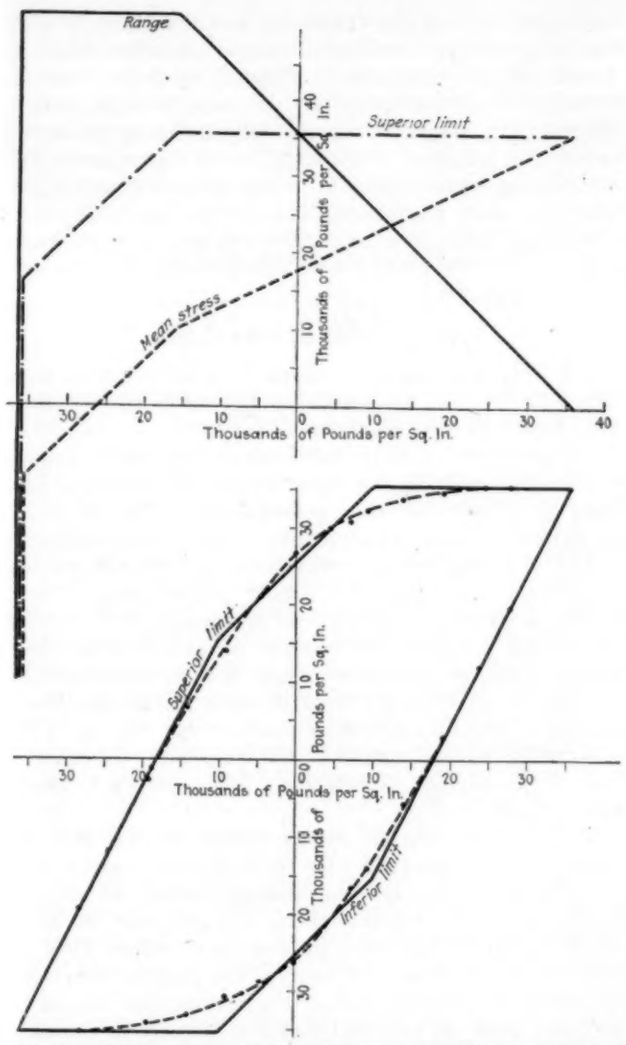


FIG. 12—YIELD TESTS COMPILED FROM SMITH'S EXPERIMENTS (FULL LINE) AND DETERMINED FROM 3-CRYSTAL MODEL (DOTTED)

will give quantitative results as well as qualitative. It is quite easy to construct a model to represent any given metal to scale. To show how accurate the results are, I will give one more illustration. Professor Smith summarized a large number of his results in a single figure giving yield ranges plotted against mean stress. I designed a model of three units to represent the same steel, and constructed to scale the corresponding graph. Fig. 12 shows the graph of the yield ranges, which is very similar to that for the fatigue ranges. On it is plotted the superior stress and the mean stress. Below it, the superior and inferior stresses are plotted on a mean stress base; the figure is a skew polygon. On this, to the same scale, I have drawn Smith's figure representing his test results. The agreement is, I think, striking. If the model could speak it would say: "I could have foretold the whole of the results of the tests which have taken you years to make."

The theory I have outlined applies to iron, steel, nickel and copper. Whether it is true for all metals is not yet known. It is not unlikely that brittle materials like cast iron may behave differently. It ought to apply to fatigue in shear as well as in tension, but whether it does has not yet been ascertained.

Perhaps you wish to know the practical end of all these researches, and may feel inclined to say: "What is the use of your pretty models and fine theories?"

We hope before long to be able to put figures into designers' hands which will be a sure basis for all their strength calculations, figures which will not need factors of safety to allow for our ignorance of the strength of the materials. We hope to introduce fatigue limits into steel specifications, so that you will buy your materials on the basis of their useful strengths. We hope to have methods of fatigue testing as simple as tensile tests. We hope to be able to issue instructions which will save endless failures of engines. All these things are already possible. We have now only to verify and confirm before issuing our reports.

I will venture to make one suggestion today to all engine builders. Never run a new engine on a full-power test till you have raised the fatigue limits of all the highly stressed parts. This can be done, as Gough and Lea have shown, for test pieces by making a series of short runs at gradually increasing loads, finishing up at the highest overload which the engine will ever be called on to exert and slowing down between each. No marine engineer ever starts up a ship's engine at full load. He coaxes it up gradually. This may be partly to give the bearings time to run in; but the experiments I have described suggest that it may also be most valuable in giving time for the steel to "slip into the central position" and to heal. A proper start may add 20 per cent to the engine's strength.

Radio Principles in Induction Heating

It is quite recently (since about 1916) that electromagnetic energy intercepted in a secondary circuit has been absorbed before it escapes and used for producing heat free from the contaminating carbon of the arc furnace.

In a recent publication of the Engineering Foundation the development of the high-frequency induction furnace is described by its inventor, E. F. Northrup, who developed it with the assistance of G. H. Clamer. It is an ironless induction furnace which in its smaller sizes is used to melt the precious metals, gold, platinum, iridium and their alloys; also samples of carbonless iron and its alloys with various metals of the tungsten group. In its larger sizes, silver and the base non-ferrous metals and their alloys are melted; also nickel and iron alloys which must be maintained extremely pure.

The heating and melting of these materials result from the direct transformation of electromagnetic energy into heat energy within the substance itself or within the walls of a conducting crucible used to hold the product heated. If the substance to be heated does not conduct electrically, Pyrex glass for example, it is nevertheless heated and melted by the same process by placing it in a crucible which is made of conducting material.

These ironless induction furnaces, depending as they do upon the passing of a high-frequency current through an inductor coil, require for their operation a source of current of much higher frequency than the current supplied by commercial circuits. So-called "high-frequency" converters (up to from 3,000 to 30,000 cycles per second) of new design have been developed especially to meet this requirement. It is but a short step, however, to adapt the high-frequency, high-power converters which have been developed for transoceanic radio transmission to the service of inductive heating. Thus, again, the electron vacuum tube arises as the genie to do useful things.

Legal Notes

By Wellington Gustin
Of the Chicago Bar

Trade Custom and Written Contract

Unambiguous Agreement Cannot Be Altered by Oral Evidence of Trade Practices

A sales contract was the basis of an action brought by the Youngstown Sheet & Tube Co. against the Etna Forge & Bolt Co. The question of custom or usage in the trade became one of the main considerations determining the final disposition of the case in the United States Circuit Court of Appeals, 282 Federal 786.

Suit was brought on the contract to recover the balance of the purchase price of 400 tons of steel bars at "$3.50 per cwt., delivered." Judgment was entered in the District Court for the full amount claimed to be due for want of sufficient affidavit of defence.

Misleading Representations Claimed

The contract provided that the seller was to ship the 400 tons of steel "at mills' convenience," which refers to convenience of the plaintiff. Defendant purchaser alleged in its affidavit of defence that in the negotiations for the sale it "made known to the plaintiff that it did not require more than 100 tons of steel for immediate delivery, but that it would require the full amount of 400 tons during the remainder of the year 1920"; that plaintiff "represented to the defendant that there was very little likelihood that any steel on the said order could be shipped before the last quarter of the year"; that delivery could not possibly be made, except from time to time during the fourth quarter of 1920; that the price of steel fell shortly after the contract was made, and that by a custom of the steel trade it was entitled to receive the steel not already shipped at the reduced price, and that defendant was induced to enter into the contract by these fraudulent and misleading representations of the plaintiff, which shipped the entire 400 tons within 6 days after the contract was made.

The trial court gave two important reasons why it entered judgment against the purchaser of the steel. It pointed out, first, that the defendant received and unloaded all the steel, notwithstanding the alleged representations, when it was not compelled to do so under its theory of the case; second, the court said damages (as claimed by the defendant) to be recovered must always be the natural and proximate consequence of the act complained of, and those results must be considered proximate which the wrongdoer from his position must have contemplated as a probable consequence of his fraud or breach of contract. Now the defence did not charge that the plaintiff contemplated a drop in the price of steel, and so the damage demanded from the plaintiff was not such natural and probable consequences of the breach as to have been in the contemplation of the parties at the time of entering into the contract.

The defence contended that the apparent inconsistency of receiving and unloading the steel when it was not compelled to do so was within its legal rights, for after discovering the fraud, he had the right to affirm the contract and recover damages on account of the fraud, or the right to disaffirm it, and he chose the former. The court was not disposed to read into the contract the allegations as to delivery being made only in the last quarter of 1920. If these claims as to shipment being agreed upon to be in the last quarter were true the court points out that a wise business precaution would have seen to it that the precise understanding between the parties was incorporated into the written contract.

Rule Cited by the Court

The contract was written, short and its terms clear. The rule of law applicable as approved by the U. S. Supreme Court in many cases is:

"When parties have deliberately put their engagements into writing, in such terms as impart a legal obligation, without any uncertainty as to the object or extent of such engagement, it is conclusively presumed that the whole engagement of the parties, and the extent and manner of their undertaking, was reduced to writing; and all oral testimony of a previous colloquium between the parties, or of conversation or declarations at the time when it was completed, or afterward, as it would tend in many instances to substitute a new and different contract for the one which was really agreed upon, to the prejudice, possibly, of one of the parties, is rejected." Greenleaf's Evidence, Section 275.

This is the rule in Pennsylvania, where this case originated. In another case the Court of Appeals said:

"It is almost always true that a written contract has been preceded by parol negotiations, and that the terms of the contract are thus agreed upon before they are reduced to writing. Of course, the parties may leave the transaction parol, and if they adopt this course the contract must be proved by oral testimony in the usual manner, but if they put the complete contract into writing afterward, they may not contradict or vary the writing, unless fraud, accident or mistake has supervened." (222 Federal 8731.)

In the present case the court said on the question of fraud that it was so indefinitely and inconsistently alleged that it doubted its sufficiency to sustain the defence offered or to serve as a basis for damages. In any event, the court said, the defendant was liable, at the latest on Dec. 31, 1920, for the purchase price of the steel, unless the custom as claimed was a valid defence.

The defendants charged that if the plaintiff had fulfilled its contract as regards the time for shipment, by a custom of the steel trade defendant would have received the advantage of the reduced price of steel on so much of its order as was undelivered at the time of said price reduction, and would have been entitled to a credit of $3,000 upon 300 tons of steel. But the court says that if the custom did exist it would not relieve the defendant from paying the contract price. Some time after the steel had been delivered and accepted by defendant the price fell.

The rule as to custom to give it the force of law is that it must be notorious, and have existed long enough to justify the inference that the parties had it in view in making their contract. Such custom must be certain and uniform and not loose and variable.

The court said the custom, if it did exist, could not aid the defendant, for the terms of the written contract

were clear and unambiguous, that the steel was to be shipped "at mills' convenience," and when so shipped defendant was to pay "$3.50 cwt. delivered."

Custom or usage in a trade may be resorted to in order to make definite what is uncertain, clear up what is doubtful, or annex incidents, but not to vary or contradict the terms of a contract. (25 Sup. Ct. 202.)

Revelation of Trade Secrets

Defendant Must Disclose Processes, So That the Truth May Be Known

In an earlier decision, but recently reported, the federal District Court through Judge Learned Hand held that a plaintiff in a suit for infringement of a patent may require the revelation of trade secrets of defendant in order to ascertain whether there has been infringement. It appears the decision has not been appealed.

The suit was for infringement of a patented process brought by the Grasselli Chemical Co. against the National Aniline & Chemical Co., 282 Federal 381, and the defendant sought to avoid answering certain interrogatories propounded to it by the plaintiff. Since the suit was for treble damages, the defendant claimed the privilege to refuse to answer the interrogatories, but as the defendant was a corporation, it could not claim such privilege. Again it denied infringement in its answer in the case and the court held that this denial, making up the issue in the case, must be a full and complete answer. Interrogatories as here under consideration are a substitute for a bill of discovery in favor of the plaintiff whereunder the latter would have been entitled to discovery as to whether the defendant practiced the invention. That being a part of plaintiff's case, the court said it was entitled to have an answer to the interrogatories which were equivalent to the discovery.

Now to establish its case of infringement the plaintiff must prove that the defendant was practicing a process made up of several elements. It would be no evidence of that fact, says the court, to procure an admission that it has practiced a process made up of some of these elements, because that would not be the same process. But it would be material evidence to procure an admission that in its process the defendant used certain of those elements. The evidence might turn out to be insufficient, but that does not make it immaterial because it may fail completely to establish the plaintiff's case, says the court.

Truth Must Prevail, Says Court

In addition the defendant urged that it should not be required to disclose its secret processes. On this question the court points that the "situation is difficult, on the one hand to secure the plaintiff's right to get relevant evidence, and on the other, to protect the defendant from disclosing secrets which are not material. In the end the right of the plaintiff to bring out the truth must prevail, in so far as the inquiry is honestly limited to the actual issue of infringement."

In this case the court says that at the hearing the questions could be asked and the defendant would be obliged to answer them, and hence they could be asked by interrogatories in advance. The result may be to compel the defendant to disclose how far it goes in the process, though it does not use the process as a whole, and that might damage the plaintiff, says the court. This, however, is an inevitable incident to any inquiry in such a case; for if the defendant may not be made to answer, the plaintiff is deprived of its right to learn whether the defendant has done it a wrong.

An earlier case was cited as holding that a defendant may refuse to answer a revelant interrogatory because it would disclose a trade secret, but Judge Hand would not so interpret the ruling.

Infringement of Patented Article

Where Such Merchandise Is Not Marked, Notice of Infringement Is Prerequisite to Recovery of Damages

What notice the records of the Patent Office gives to the world is involved in an infringement suit brought by the Flat Slab Patents Co. against the Northwestern Glass Co. to recover damages for the infringement of patent 698,542, issued April 29, 1902, to Orlando W. Norcross for improvements in "flooring for buildings." 281 Federal 53.

Section 4,900 of the Revised Statutes of the United States provides that a patentee must mark articles manufactured and sold as patented and that no damages shall be recovered for infringement except on proof that the defendant was duly notified of the infringement. Therefore where articles sold were not so marked or labeled, the court held that a notice of infringement was a prerequisite to recovery of damages, even though the patentee did not manufacture or sell the patented article and only granted licenses to others to engage in such manufacture.

Plaintiff contended that as it had never been engaged in manufacturing or selling the patented article it was not barred from recovery of damages under the statute. The court answers this by saying that it is true that under the law a patentee is not obliged to manufacture and sell the patented device. But the reason for giving some kind of notice to the alleged infringer would be as great or greater where the patented product was not manufactured or sold by the patentee as where it is. And the court held the requirement of notice was not limited here.

Patent Office Record Not Sufficient Notice

Counsel for plaintiff contended that the record of the Patent Office was sufficient notice of plaintiff's patent. The court said, however, that if the patentee was within the statute for giving notice he must give the notice the statute requires, and may not excuse himself by claiming that the record in the Patent Office was sufficient notice.

The case of the U. S. Mitis Co. vs. Carnegie Steel Co., 89 Fed. 206, and a number of other cases were cited in support of the proposition that when none of the patented devices have been made and sold, or where the patent is exclusively for a process, the section of the statute requiring notice does not apply. In the Carnegie Steel case the court there decided the section of law as to notice was not applicable where the patent in suit was exclusively for a process. But it was here pointed out that it was charged and not denied that the infringement was "after full notice" of the plaintiff's rights under his patent. This case is no authority that the statute does not apply where the patentee does not vend or sell. The court was not satisfied that any of the cases was an authority, and controlling, and therefore it thought that, after examining the statute, sound reason required applying the statute in this case.

Machinery and Appliances for Production and Control

Equipment News

From Maker and User

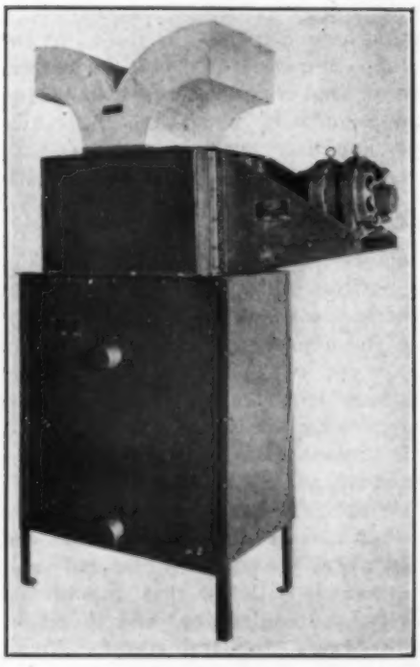
Materials and Accessories for Chemical Industries

Unit Heater for Industrial Plants

The York Heating & Ventilating Corporation, of Bridgeport, Pa., has recently placed on the market a unit heater which it recommends for industrial heating and ventilating purposes.

The makers of this equipment claim for it several advantages that have not been embodied in previous units of this type. In the first place the heating coil is made of the best grade of pipe with all joints at both headers welded and the whole is tested to a pressure of over 200 lb. per sq.in. This permits the unit to be used with either high- or low-pressure steam as desired. Another distinctive feature is claimed in the air-circulating fan. This fan has been provided with ball bearings so as to insure quiet and vibration-free operation. In the accompanying photograph is shown this unit provided with a bracket on one side upon which the motor is mounted and direct connected to the circulating fan.

This heater is provided with a discharge outlet at the top which will direct the air in one, two, three or four directions as desired. The air inlet at the bottom takes the air from all four sides, thus having a low velocity of entrance and insuring the removal of the cold air from the floor, where it naturally settles. These units are supplied from a capacity of 346,000 B.t.u. per hour and a circulation of 3,870 cu.ft. of air per minute up to a maximum capacity of 1,850,000 B.t.u. per hour, and 9,820 cu.ft. of air per minute.



IMPROVED UNIT HEATER

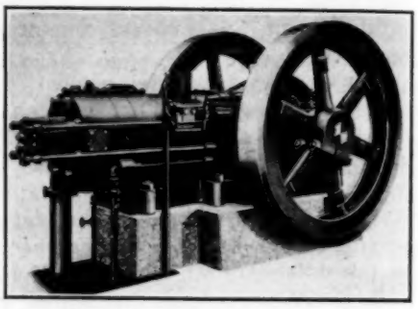
Horizontal Oil Engine

The Ingersoll-Rand Co., 11 Broadway, New York City, has placed on the market a horizontal oil engine for which are claimed numerous advantages.

This engine has as its distinguishing feature the employment of the Price system of fuel injection. In this system the oil is pumped by an ordinary pump into the cylinder through two spray nozzles, the sprays of which impinge one upon the other. The manufacturer lays stress on the fact that the head and combustion chamber of the cylinder have their surfaces so shaped that all points are parallel to the sides of these sprays. This is to prevent the fuel fog from coming in contact with a metallic surface that would condense it.

Outside of this one difference, the Price type of oil engine is exactly similar to a Diesel engine. The manufacturers claim that by the introduction of this new type of fuel injection they have made a saving in mechanical efficiency of 10 to 12 per cent through eliminating the air compressor. In this connection they claim that a fuel consumption of 0.38 to 0.39 lb. of oil per brake-horsepower-hour is attained with ease. That is, a production of 20 hp.-hr. per gallon of standard fuel is obtainable.

High lubricating oil economy is also claimed for this unit, special care having been taken in the design to embody such features as would count for a saving in lubricating oil. In connection with this effort, a cast-iron case has been used for covering the moving parts, such as the crank, rather than a sheet-iron case, because it is found that this effects a saving in lubricating oil, as it has no vibration to cause splashing. The manufacturers claim a delivery of 4,000 hp.-hr. for each gallon of lubricating oil used. The accompanying photograph shows this new horizontal oil engine.



HORIZONTAL OIL ENGINE

Rubber-Lined Acid Tank

For the purpose of storing hydrochloric acid, the Hauser-Stander Tank Co., of Cincinnati, Ohio, has had on the market for some time a rubber-lined storage tank.

These tanks are especially made for lining with rubber, having fillets and wearing pieces so placed that the rubber lining is subjected to the least possible wear. The lining itself is made of pure rubber from $\frac{1}{16}$ to $\frac{1}{8}$ in. thick and is cemented to the wooden tank by a special process. The cover is either lined with rubber or coated with special pitch paint.

The tank is provided with a Duriron or hard rubber pipe and plug-cock outlet. Other equipment of hard rubber or Duriron, such as pumps, piping, etc., can be used in connection with this equipment as desired. The manufacturer states that the system of storing hydrochloric acid in rubber-lined tanks shows an appreciable saving over any other method such as storage in carboys.

The Arca Regulator

The Arca Regulator is manufactured by the Aktiebolaget Arca Regulatorer of Stockholm, Sweden, and by British Arca Regulators, Ltd., of London, England. This device, which is the invention of Mr. Ragnar Carlstedt, is for the purpose of regulating apparatus in which variations of temperature, pressure, voltage, humidity, steam, density or other physical quantity occurs. It is in use for the purpose of regulating numerous types of equipment where sensitive and accurate regulation is required.

The principle of operation is as follows: The main features of the device are a pilot valve and a relay operated by a low hydraulic pressure. The variation in the physical quantity which is to be regulated acts on the relay. This relay controls the pilot valve, which in turn, through the amount of water which it allows to flow past, operates the mechanism which actually controls the equipment which it is desired to regulate.

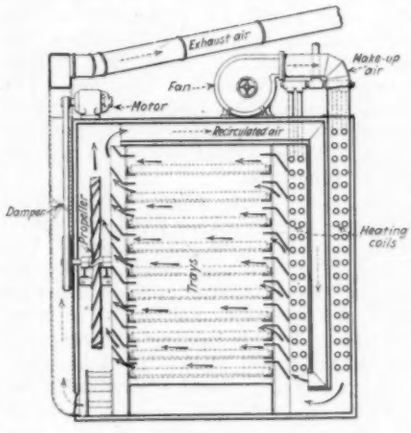
The relay consists essentially of a lever pivoted on one end and having the other end so located that it governs the opening of a jet of water which reaches the relay from the pilot valve. The position of this lever, and hence the amount of water flowing through the jet, is controlled by some such element as a copper bellows for pressure regulation, an ebonite strip for temperature regulation and other appropriate devices depending on the type of physical quantity to be controlled.

The amount of water which flows in the jet controls—through a diaphragm and spring—the position of the pilot valve. This pilot valve will in turn govern the amount of water which flows to the regulating device as against that which is allowed to flow to waste and hence governs the action of this regulating device. The regulating device is generally a hydraulic cylinder. The amount of water used is small and in most cases city pressure will suffice to actuate the regulator.

Up to the present time the installations of this apparatus have all been in Europe. The majority of these have been for the purpose of controlling steam or gas pressure. Others have been used for the control of the temperature of heat-treating furnaces. Among the most interesting applications have been one for controlling the position of the electrodes for an electric furnace, and one for controlling the flow of pulp in a paper machine.

Judelson Drier

Within the past decade great advances have been made in constructing shelf driers. In the old type of drier a material was frequently "casehardened," or in other words, the outside surface was dried rapidly and formed a crust, leaving the inside still wet. To overcome this a number of different designs were placed on the market using slightly moist air rather than absolutely dry air. The drying was thus effected more evenly and no casehardening resulted. One rather serious difficulty with many of the designs was the uneven drying of the various trays in the drier. In other words, the air would pass more effectively over one tray than another.



THE JUDELSON DRIER

To avoid this the Judelson drier, manufactured by the Domestic Laundry Equipment Corporation, places the trays in such a manner as to obtain an even distribution of the drying air. This will be seen by referring to the sketch, which shows the trays fairly wide apart at the top of the drier and increasingly close together toward the bottom.

The air comes into the system through the fan at the top and is forced down over steam coils at the right-hand side of the apparatus. At the bottom of the chamber it blows underneath a baffle plate and meets the return air, which has been recirculated. This mixture is the drying medium and is distributed through the drying trays by means of angle-iron deflectors. At the other side of the apparatus a large fan sucks the air through the trays and forces it partly through the return pipes, which pass just under the top of the drier and partly out through the exhaust pipe, shown in the photograph. A damper in the effluent pipe regulates the amount of air which is returned to the system and thus it is easy to obtain air of any degree of humidity or saturation for drying. Substantial proof that the distribution of drying air is fairly even is obtained by reading the two thermometers in the door of the drying chamber. Both the one at the top and the one at the bottom check during the drying of a given material. The equipment in addition embodies all the usual features of a drier, being insulated, substantially built, easy to control and cheap in operation.

Catalogs Received

KANSAS CITY OXYGEN GAS CO., Kansas City, Mo.—Catalogs 10 and 11. Catalog 10 describes equipment for doctors, hospitals and laboratories for the use of nitrous oxide, oxygen, hydrogen and carbon dioxide. Catalog 11 describes apparatus and other specialties used in connection with oxy-welding and cutting.

GENERAL ELECTRIC CO., Schenectady, N. Y. Bulletin 41,316, describing synchronous motor drive for ammonia compressors, and Bulletin 46,053, describing a portable timing device which is used to supplant the stop watch in connection with timing instruments and other appliances.

DE LAVAL STEAM TURBINE CO., Trenton, N. J.—Publications E1051, E1052 and E1053. E1051 describes the use of De Laval equipment in the textile dyeing and finishing plant of the United States Finishing Co. at Norwich, Conn. Bulletin E1052 describes an installation of De Laval steam turbine equipment in a byproduct coke plant of the New England Fuel & Transportation Co. at Everett, Mass. Bulletin E1053 describes the use of De Laval centrifugal pumps in an irrigation project in California.

AJAX ELECTROTHERMIC CORP., Trenton, N. J.—Bulletin 2—Describes the Ajax-Northrup 15-kva. converter and small furnace for temperatures up to 2,000 C., which is used for electric furnace work in the laboratory.

GRAVER CORP., East Chicago, Ind.—Bulletin 509, Feb. 1, 1923. A new issue of the Graver Corporation's bulletin on Zeolite Water Softening.

SULLIVAN MACHINERY CO., Chicago, Ill.—Circular 72-G. A handbook on rock drill steel, treating of its selection, heating, forging and tempering. This catalog also contains instructions for the care and use of drill sharpeners and drill steel furnaces.

SPEERE ENGINEERING CO., Detroit, Mich.—Pamphlet 244. A leaflet covering the Speere design of the Doherty direct condensation apparatus for water gas, known as the Doherty washer-cooler.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa.—Several new leaflets as follows: No. 1611, describing Type AF automatic auto-starters for polyphase squirrel cage induction motors. No. 1161-A, describing large squirrel cage induction motors of Type CF. No. 1765, describing motors for Westinghouse-Baldwin mine locomotives, series 900. No. 2390-A, describing Type E engine-driven alternating current generators. No. 3400, describing Type F-10 oil circuit breakers. No. 3499-A, describing Type CF control switches.

SCHUTTE-KOERTING CO., Philadelphia, Pa.—Bulletin 4-C, describing the Koerting venturi stack draft system. Bulletin 7-C, describing the Koerting centrifugal acid pump. Bulletin 17-A, describing the Koerting gear pump for viscous liquids.

SWENSON EVAPORATOR CO., Harvey, Ill.—Bulletin P-123. A new bulletin describing the Swenson reclaiming machinery for soda or sulphate processes, for use in pulp and paper mills.

Synopsis of Recent Literature

Elastic Limits of Fatigued Steel

Leonard Bairstow read a paper before the Royal Society of England (*Philosophical Transactions*, vol. 210A, p. 35) on "Elastic Limits of Iron and Steel Under Cyclical Variations of Stress," in which he described a series of experiments on an "axle steel" containing C 0.35 per cent, Mn 0.75, and with yield point 56,000 lb. per sq.in., maximum strength 85,500 and elongation in 2 in. 33.5 per cent. Similar experiments gave consistent results on a harder bessemer steel and Swedish iron. His tests were made on small tensile specimens mounted in a single-lever tension machine, so arranged that stresses could be alternated leisurely and automatically. A delicate optical extensometer measured the changes in length during the operation of the machine, studies being taken at intervals after the specimen had adjusted itself to conditions.

First tests on the axle steel were made with the stresses alternating between a stress of 31,600 lb. per sq.in. in tension and the same amount in compression. For several thousand repetitions of stress the steel was truly elastic—i.e., a stress-strain curve was a straight line going through the origin. As the test progressed, however, a slight hysteresis loop showed up in the stress-strain curve even when working between the same limits—that is, the line representing conditions during loading bent slightly, then as the load was released the specimen recovered in an elastic manner and drew a straight line. Conditions were exactly opposite during the compression cycle. The total stress-strain curve therefore appeared as a loop, the width of which represented the permanent set caused by one repetition of the load. After 19,000 repetitions of $\pm$31,600 this "cyclical permanent set" measured by the width of the hysteresis loop equaled 11 per cent of the original elastic change. This loop, however, is fairly narrow compared with others obtained on heavier loading, and the author thinks that if the load alternated between 29,000 lb. per sq.in. in tension and 29,000 lb. per sq.in. in compression, the specimen would act in a truly elastic manner. In other words, the "superior" elastic limit of the original bar as determined by alternating load is 29,000 lb. per sq.in. in tension; the "inferior" elastic limit is 29,000 lb. per sq.in. in compression and the elastic range for symmetrical load is 58,000 lb. per sq.in.

After 19,000 repetitions the load was changed to 33,500 lb. per sq.in. in tension and compression. The narrow hysteresis loop immediately widened and gradually attained a certain width. Increasing the number of repetitions does not seem to change this, except that for very heavy loads it actually seems to decrease somewhat from the width assumed just after readjustment to the increased load. In other words, the specimen has apparently a "self-healing" property.

Loads were increased by steps, after the previous set of conditions seemed to be stationary. As the hysteresis loops widened, they continually showed the same nature; the curve on loading, either in tension or compression, is inelastic, but the specimen recovers in a truly elastic manner. Just before the specimen broke the extensometer was working perfectly and measuring distances equal to 1/100,000 of the length of the specimen. Therefore, the damage which is done by fatigue stresses is extremely localized. "It would appear that individual slips in the crystalline grains cannot have increased their extent prior to failure due to repetition."

To study the effect of unequal stresses, a first series fixed the maximum at 41,000 lb. in tension. The range of stress was increased by reducing the minimum stress, starting first at 18,500 lb. per sq.in. in compression. As this loading was repeated the stress-strain curve (which originally was truly elastic) gradually developed a hysteresis loop, and after 27,000 cycles, the width of this loop remained constant. On relieving the load, the specimen was found to have acquired a permanent extension, even though the maximum stress, 41,000 lb. per sq.in., is considerably below the yield point (56,000). As the loading continued this permanent extension increased at a very small but steady rate. Increasing the stress range by changing the compression stress to 21,800 lb. per sq.in. immediately increased the width of the hysteresis loop. No sudden increase in the permanent extension occurred, but it increased at a more rapid rate. In other words, if the permanent extension were plotted against the number of repetitions, it drew a straight line sloping upward at a slight angle. Every increase in the range of load was characterized by an angle in this line—the slope became steeper. The shape of the hysteresis loop remained exactly similar to that observed during symmetrical loading—i.e., the metal was plastic during half its loaded cycle, and perfectly elastic during the first half of the unloading cycle. The stress-strain curve is symmetrical about the average stress rather than about the zero load.

A second series of experiments with unequal stresses was then made with the superior stress at 52,000 lb. per sq.in. (still below the yield point) and the inferior stress at zero. The steel acted in a perfectly elastic manner until 2,000 repetitions had passed, then a rapid permanent extension occurred; simultaneously a hysteresis loop developed to measurable quantity, but remained stationary in width from 8,000 to 15,000 cycles. During this time the permanent extension remained nearly constant. The author thinks that a slightly lower range would have stabilized both these conditions and the steel would have been stable, even though a slight hysteresis loop would have been observed. This might have remained temporarily, but "there is every reason to believe that it would have disappeared by recovery if sufficient time were allowed. An extension of 0.2 mm. would have been produced in the process of raising the superior elastic limit from 29,000 to 51,500."

Other tests were made, one series starting with a maximum of 63,700 lb. per sq.in. in tension and an inferior stress of 17,000 in tension. Since the superior stress is above the yield point, a permanent extension occurred at the first load, but did not progress. A very narrow hysteresis loop was observed, gradually growing narrower.

Important Articles In Current Literature

More than fifty industrial, technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

THE USE OF BREATHING APPLIANCES IN CHEMICAL WORKS. Leonard Levy. *Chemical Age* (London), April 7, 1923, pp. 362-3.

THE CENTENARY OF THE ALKALI INDUSTRY IN ENGLAND. (To be cont'd.) Anon. *Chemistry & Industry*, April 20, 1923, pp. 383-6.

THE PRINCIPLES OF TRANSFERENCE OF HEAT. (To be cont'd.) Geoffrey J. Greenfield. *Chemistry & Industry*, April 20, 1923, pp. 390-2.

MANUFACTURE OF SODIUM THIOSULPHATE. L. Hargreaves and A. C. Dunningham. *J. Soc. Chem. Ind.*, April 13, 1923, pp. 147-154T.

JOINT CONFERENCE ON CORROSION PROBLEMS. *Chemical Age* (London), April 14, 1923, pp. 394-6.

SEABOARD LIQUID PURIFICATION PROCESS. H. R. Broker. *Gas Age-Record*, April 21, 1923, pp. 499-500.

KEEPING LOST TIME WITHIN BOUNDS. James J. Martindale. *Factory*, May, 1923, pp. 518-520.

LIGHTING THE FACTORY. S. G. Hibben. *Factory*, May, 1923, pp. 523-526.

TRENDS IN MANAGEMENT. William Leavitt Stoddard. *Factory*, May, 1923, pp. 528-529.

LIGNITE CHAR: ITS PRODUCTION AND POSSIBILITIES. O. P. Hood. *Mechanical Engineering*, May, 1923, p. 282.

ALUMINUM BRONZE AS AN ENGINEERING MATERIAL. W. M. Corse. *Mechanical Engineering*, May, 1923, pp. 283-4.

MANAGEMENT ENGINEERING IN THE PAPER INDUSTRY. R. B. Wolf. *Mechanical Engineering*, May, 1923, pp. 295-6.

THE OIL VENTURI METER. Ed. S. Smith, Jr. *Mechanical Engineering*, May, 1923, pp. 297-298.

LES ACCUMULATEURS DE VAPEUR. M. Emanaud. *La Technique Moderne*, April, 1923, pp. 193-197.

Other tests starting with a superior load of 77,000 lb. per sq.in. in tension and an inferior load of 42,500 lb. in tension acted in the same way. In this series the hysteresis loop gradually decreased in width and finally traced a straight line. Increasing the range by decreasing the lower limit to 34,000 lb. per sq.in. in tension did not change these conditions. Further decrease, however, immediately increased the hysteresis loop and caused the permanent extension to increase. However, the loop was very narrow even later when the extension was increasing rapidly to failure.

In general, it was found that the hysteresis loops were similar for all fatigue stresses: they contain evidence of elastic recovery for one-half the cycle. The width is greatest at equal and opposite stresses, decreasing in width as the load is unbalanced. It is probably zero at the limit. Permanent extension due to a superior load above the elastic limit rapidly grows when the piece nears failure. At the beginning of a test a large permanent extension may occur on the first overload, but if the stresses are not excessive remain stationary as the hysteresis loop approaches zero. In these circumstances the author thinks that the specimen may be safe—that is, acting in a truly elastic manner—even though at first it appears to have a cyclic permanent set. An experiment illustrative of this point is on a bar of Swedish iron which was strained between 20,000 lb. per sq.in. in tension to 18,500 lb. per sq.in. in compression. It acted in an elastic manner to 100,000 repetitions, and suddenly developed a hysteresis loop, which remained constant, even up to 1,000,000 repetitions. The specimen was unbroken, and was laid aside for months, after which it was tested again in a similar manner. Its elasticity was completely restored. Therefore the author is of the opinion that the appearance of a narrow hysteresis loop is not necessarily a sign that failure impends.

The accompanying table contains approximate data on the elastic ranges under these cyclic tests. If the range of stress is plotted against the minimum (inferior) stress the curve shown in Fig. 8 of Prof. Jenkin's article on p. 813 of this issue may be had.

ELASTIC RANGE OF AXLE STEEL UNDER STRESS

Superior Stress	Inferior Stress	Range, Lb./Sq. In.
+29,000	—29,000	58,000
+39,000	—17,000	56,000
+52,000	0.0	52,000
+63,000	+18,000	45,000
+76,000	+34,000	42,000

If this steel is tested in a tension machine in the ordinary way, it acts in an elastic manner and acquires no permanent set up to 56,000 lb., whereupon the yield point occurs and a rapid permanent stretch occurs. However, the above-described experiments show that an unbalanced cyclic load with a maximum *less* than the yield point will develop a gradual permanent extension. This occurs at any load below the yield point and above 29,000 lb. per sq.in. The latter figure might be called the "natural" elastic limit. "Below the static yield point, iron and steel appear to be capable of maintaining an unstable condition for a considerable time against cyclical variations of stress which ultimately produce a considerable change of length. Bauschinger's 'primitive' and 'natural' elastic limits really state that ordinary extensometers are not sufficiently sensitive to detect the first signs of want of elasticity, and that fatigue increases these signs to recognizable magnitude."

Bairstow then goes on to compare the elastic ranges which he determined by the same methods described above for Swedish iron, axle steel and hard bessemer steel with similar materials actually tested in fatigue under unbalanced stresses by Wöhler. These curves are reproduced as Fig. 8 of Prof. Jenkin's paper, p. 813 of this issue. The agreement is so very good that the author believes it establishes the identity between elastic range and safe fatigue range. He, therefore, restates Bauschinger's theorem as follows: "The superior limit of elasticity can be raised or lowered by cyclical variations of stress and at the same time, the inferior limit of elasticity will be raised or lowered by a definite, but not necessarily the same, amount. The range of stress between the two elastic limits has, therefore, a value which depends only on the material and the stress at the inferior limit of elasticity. This elastic range of stress is the same in magnitude as the maximum range of stress which can be repeatedly applied to a bar without causing fracture, no matter how great the number of repetitions."

Can Gasoline Be Made From Animal and Vegetable Oils?*

The motor fuel problem in France is a peculiar one and its solution would justify unusual methods. The fact that France is dependent upon foreign sources of supply for petroleum has led to an intensive investigation of various substitutes for mineral oils. Most of the attempts to solve the motor fuel problem have turned around alcohol, naphthalene and various other substitutes that have been tried in other countries with varying degrees of success. There is one raw material, however, which France seems to possess in an almost inexhaustible supply, that has only recently been considered in connection with the possibilities of developing a gasoline substitute. The crude vegetable oils that the French colonies are able to produce in almost unlimited quantities have previously been used solely as food products or in the manufacture of soap, paint, etc. They have never been used for combustion, except in certain special Diesel engines and then only on a small or experimental scale.

The work of Professor Mailhe, an associate of Sabatier at Toulouse, has demonstrated that by a catalytic dehydration these oils may be disintegrated to yield water, acroleïn, combustible gases and low-boiling liquids. The catalyzers used were magnesium oxide, kaolin and alumina. This process is then followed by hydrogenation, using metallic copper, preferably electrolytic, as a catalyst. Its action is less pronounced than that of nickel and iron, and therefore it causes less carbon to be deposited. To prepare the catalyst equal parts of powdered copper and magnesium oxide are mixed, using glue or starch as a binder. Small balls made from this mixture are air-dried and introduced into a copper tube 1½ in. in diameter, 40 in. long and heated to 500 deg. C. by a row of bunsen burners. The temperature should never exceed 650 deg. C. The oil is introduced at one end of the tube, where its input is regulated by a needle valve. The incoming oil vaporizes immediately and after the vapors pass over the catalyzer they leave the tube to enter refrigerating coils and absorption apparatus.

Decomposing Linseed Oil

With this simple equipment Professor Mailhe studied the decomposition of linseed, palm, whale, fish, coconut and cottonseed oils. Linseed oil produced an abundant supply of gas and considerable quantities of low-boiling liquids. The composition of the gases so obtained was CO_2 6 per cent, CO 9 per cent, C_nH_{2n} 54 per cent, $C_nH_{2n} + H$ 31 per cent. The liquid products were of mahogany color with a strong odor and acid reaction. On redistillation they were split up into three fractions distilling below 40 deg. C., between 50 and 150 deg. C. (density 0.76) and between 150 and 230 deg. C. (density 0.86). The residue was retreated in the catalyzer. Washing the direct acid condensate with diluted soda solution changed the color to a light yellow. Analysis showed the presence of hydrocarbons almost exclusively and the liquid resembled cracked gasoline in appearance and in properties when used in internal combustion motors.

When submitted to further hydrogenation in the presence of metallic nickel at about 180 deg. C., a water-white liquid was produced which had no disagreeable odor and made up almost entirely saturated compounds.

A study of the composition of the original condensates showed that they consisted of complex mixtures of paraffine, aromatic and cyclo-paraffine hydrocarbon.

Numerous tests were made by Professor Mailhe on samples of other oils of animal or vegetable origin and of various fatty acids and their glycerides. All were found to yield the same or similar results as those previously described for linseed oil.

In general it may be said that the process consists of two steps as follows: (1) Rupture of the complex glyceride and the elimination of the oxygen in the form of water, acroleïn, CO and CO_2. Excess acids are neutral-

*An abstract of a paper by Prof. A. Mailhe of Toulouse, France presented at the International Congress of Liquid Fuels in Paris, France, October, 1922, and appearing in *Chimie et Industrie*, February, 1923. Translated by Joseph F. Shadgen, Consulting Engineer, New York City.

ized with soda to give a product resembling unrefined cracked gasoline. (2) Transformation of that liquid into a water-white saturated gasoline or kerosene by the catalytic hydrogenation in the presence of metallic nickel. Either water gas or pure hydrogen can be used in the hydrogenation.

If desired, the oils may first be saponified to yield glycerine. The remaining fatty acid may then be put through this process to yield first a rich gas of exceptionally high heat value, and second a mixture of liquid hydrocarbons which boil somewhat below 250 deg. C.

Laboratory tests indicate that on the average a ton of crude oil will yield 10,500 to 11,500 cu.ft. of gas and 650 to 750 lb. of motor fuel. It is evident, of course, that at the present value of vegetable or animal raw materials it is extremely impractical. Its only value lies in the possibility of developing the almost inexhaustible resources of the tropics on a scale such as has been approached by systematic plantation of rubber and other colonial products. If the deposits of mineral oil are ever exhausted it may be that such a process as this will provide our future motor fuel.

Review of Recent Patents

Dehydrating Chlorhydrin Solutions—Ethylene and propylene chloryhydrins, when in very concentrated or anhydrous form, are excellent solvents for natural and synthetic resins, particularly copals, for fatty oils, and for use in varnishes, cellulose ester solutions and lacquers. Small amounts of water seriously interfere with these applications. For example, ethylene and propylene chlorhydrins containing 8 per cent of water will only partly dissolve copals. Concentration of dilute chlorhydrin solutions by fractional distillation is difficult, since constant boiling mixtures are formed. Benjamin T. Brooks, of Bayside, N. Y., has found, however, that saturation of the fractions with an inert salt improves the separation, the method being as follows:

A 5 per cent aqueous solution containing ethylene and propylene chlorhydrins is distilled through an efficient fractionating column until about 40 per cent of the solution has been distilled. The distillate is saturated with common salt and distilled again and the second distillate thus obtained is saturated with common salt. The aqueous saline solution is separated from the oily chlorhydrin layer and returned to the still for reconcentration. The oily chlorhydrin layer is treated with an equal volume of benzene and the aqueous layer thus formed is separated and also returned to the still. The benzene solution is distilled, thus recovering the benzene, and the fraction boiling from 126 to 134 deg. C. is collected as anhydrous chlorhydrins. As thus prepared the chloryhdrins are excellent solvents for copals and cellulose esters and may be incorporated in other solvent mixtures in which aqueous chlorhydrin mixtures could not be used. (1,446,874. Assigned to Chadeloid Chemical Co. Feb. 27, 1923.)

Manufacture of Oxygen and Hydrogen—Electrolytic hydrogen and oxygen may be produced at an increased rate by a method patented by F. G. Clark of Toronto, Canada. By increasing current densities and likewise the temperature of operation, greater output of gas per unit area of electrolyte cross-section, between electrodes, is obtained. Standard cells are used, such as that covered by United States patent 1,269,566 to MacDougall and Middleton. The improved method of manufacture depends upon the fact that relationship of space between electrodes to temperature has been found to exist. If the electrodes are spaced under ¼ and over ⅛ in. and if diaphragms of asbestos cloth are used, the current density and consequently the temperature may be increased. The current density may be raised from 0.25 ampere per square inch, which has been the maximum density obtainable in the past, to from 1.5 to 3 amperes per square inch. A temperature of 90 to 95 deg. is employed and an aqueous electrolyte consisting of 17 per cent caustic soda is used. The voltage required when operating at a density of 3 amperes per square inch and a temperature of 95 deg. is approximately 2.5. To facilitate the removal of the gases evolved at the electrodes, porous material, the composition of which is not specified, is used in making these. (1,446,736. Feb. 27, 1923.)

Preparation of Solid Preservative Substance for Rubber Latex—The preservative used in transporting rubber latex, which is alkalized phenol, may be obtained by a method patented by S. C. Davidson, deceased, of Belfast, Ireland. Since the transportation of this alkalized phenol in fluid-tight metal

American Patents Issued April 24, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,452,520—Process for Carrying Out Continuous Fusions. W. O. Mitscherling, Wilmington, Del., assignor to Atlas Powder Co., Wilmington, Del.

1,452,553—Dechlorinated Chlorinated Glycerides and Derivatives Therefrom. H. A. Gardner, Washington, D. C.

1,452,573—Electrodeposition of Tin. L. D. Simpkins, Brooklyn, N. Y., assignor to National Lead Co., New York City.

1,452,589—Electrolytic Cell—D. A. Brading, Chicago, Ill.

1,452,594—Thermally Insulated Apparatus and Method of Insulating the Same. G. Claude, Paris, France, assignor to Société l'Air Liquide Société Anonyme pour l'Etude des Procèdes Georges Claude, Paris, France.

1,452,605—Arsenical Compound. L. M. Hussey, Philadelphia, Pa., assignor to J. P. Harmer, Philadelphia.

1,452,617—Process of and Apparatus for Distilling Liquids. W. E. Sanger, New York City, assignor to William Garrigue & Co., New York City.

1,452,662—Method of Recovering Zinc From Lead Zinc Ores. R. V. Smith, Eureka, Utah.

1,452,739—Decolorizing and Purification of Saccharine Materials. J. J. Hood, P. G. Clark of London and John Clark of Hutton, England.

1,452,750—Readily Fusible Alloy. A. D. Mulligan, London, England.

1,452,774—Intermediates and Dyestuffs of the Anthraquinone Series. F. W. Atack, Manchester, England, and C. W. Soutar, St. Andrews, Scotland.

1,452,778—Process and Apparatus for the Recovery of the Vapors of Volatile Liquids From Aëriform Mixtures. E. A. Barbet, Paris, France.

1,452,805—Dyestuffs Containing Sulphur and Dyeing Vegetable Fibers Without a Mordant and Process of Making the Same. R. Herz, Frankfort, and H. Balhorn, Hochst, Germany, assignors to Leopold Cassella & Co., a corporation of Germany.

1,452,813—Method of Decomposing Mixed Metal Salt Solutions. H. Pauling, Berlin, Germany.

1,452,815—Process of and Apparatus for Grading Solid Materials. C. J. Reed, Glenside, Pa.

1,452,898—Process of Treating Rock Asphalt. J. B. Smyth, Beaumont, Tex.

1,452,928—Drying Kiln. E. F. Perkins, Chicago, Ill.

1,452,934—Zinc Smelting Furnace. B. Raeder, Kykkelsrud, Norway, assignor to himself and to A. Zink, both of Kykkelsrud.

1,452,966—Agitator. C. Field, Yonkers N. Y., assignor to Chemical Machinery Corp., New York City.

1,452,971—Carboy. F. E. Hodes, Denver, Colo.

1,453,021—Preparation for Dyeing Furs, Hairs and the Like. P. Onnertz, Berlin, Germany, assignor to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.

1,453,037—Apparatus for the Treatment of Naturally Occurring Hydrocarbon-Containing Materials. C. P. Bowie, Berkeley, Calif., and M. J. Gavin, Boulder, Colo.

1,453,060—Conversion of Ammonia Into Ammonium Chloride. C. Bosch and C. Kircher, Ludwigshafen, and E. Dehnal, Rossen, assignors to Badische Anilin & Soda Fabrik, Ludwigshafen, Germany.

1,453,113—Drying Cylinder. E. Hutchins, New York City, assignor to International Paper Co., Inc., of New York.

1,453,132—Process for the Recovery of Pure Alkalis From Impure Lyes. K. Heinemann, Heidenau, Germany.

1,453,210—Process for Purifying the Residue Obtained in Producing Ammonia From Cyanide. C. T. Thorssell, and L. R. Lunden, Gottenberg, Sweden, assignors to Aktiebolaget Kvafveindustri, Gottenberg.

1,453,215—Method of Volatilizing, Distilling, or Separating Absorbed Vapors. C. L. Voress, New City and V. C. Cantor, Bradford, Pa., assignors to Gasoline Recovery Corp., of Delaware.

1,453,254—Alloy and Process of Making Same. A. B. Norton, Cleveland, Ohio, assignor to Aluminum Manufacturers, Inc., Cleveland, Ohio.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

drums is very expensive, the solid form is desirable. In carrying out the proposed method of preparation, 2 parts by weight of phenol crystals are mixed with 1 part by weight of caustic soda in solid form. These ingredients are mixed or ground together in a warmed receptacle for a few minutes, during which time the mixture becomes semi-fluid. Gradually it assumes the condition of a fine white powder. Under pressure, this powder may be pressed into solid blocks. These blocks may be readily transported in lead-lined wooden boxes out of contact with the air. (1,447,930. March 6, 1923.)

Smokeless-Powder Dynamite—L. H. Jones of Kenvil, N. J., has assigned to the Hercules Powder Co., of Wilmington, Del., the following patent covering the production of smokeless-powder dynamite. Ordinary smokeless gunpowder is utilized in admixture with either sodium nitrate or ammonium nitrate, chalk, nitro-glycerine and water. Wood pulp and corn meal may also be used to give bulk, while at the same time a certain amount of the smokeless powder may be replaced by trinitrotoluol. The moisture content of the materials going into the explosive must be less than 2½ per cent and, better, not over 1 per cent. The nitroglycerine is primarily included for the purpose of agglutinating any smokeless powder and nitrate dust that may be present and thus insure against premature explosion, and at the same time assure regulatable detonation. The sensitiveness of the mixture is controlled by varying the relative amount of the nitrates employed and also by decreasing or increasing the amount of ammonium nitrate in comparison with the amount of smokeless powder. The resulting explosive is safe to use and to transport. It is dry, non-balling, non-freezable and may be readily loaded into cartridges or boreholes. (1,447,248. March 6, 1923.)

Composition of Matter for Use as a Roof Paint—To J. Gower and H. Wolfe, of Sparta, Ill., a patent has been granted for a roof paint the composition of which involves inexpensive materials and for which claims are made of great resistance to deterioration and the action of the elements. This material is impervious to the action of the sun's rays and also to moisture.

The recommended proportions are 1½ qt. coal tar; 1½ qt. of melted rubber compound, and 1 qt. of varnish. These are mixed together thoroughly, the tar and rubber compound forming the body of the paint, while the varnish acts as a drier and renders the paint more elastic than would otherwise be the case. (1,447,208. March 6, 1923.)

Viscose Threads and Filaments—Unevenness in size of cellulose threads, filaments, etc., made from viscose, due to globule formation, can be overcome by a method patented by H. J. Hegan, of Coventry, England. In the usual process of fabrication the viscose is forced through an orifice into an acid bath containing only sulphuric acid, some sulphate and such compounds as glucose and zinc salt. During this process tendency for globules to form and pass on to the winding apparatus is common. By the addition of sodium oleate in the proportion of 2 parts to 10,000 of viscose this tendency may be overcome. The addition of the sodium oleate may be made during the manufacture of the viscose, but it is made preferably afterwards, or just previous to the time of thread and filament formation. (1,446,301. Feb. 20, 1923.)

Reduction of Nitro-Compounds—An improved method for the reduction of nitro-compounds to amino-compounds has been patented by D. A. Legg, of London, England. This is based mainly upon the use of an improved catalyst which consists of fused copper oxide prepared as indicated in British patent application 21,667. This is claimed to work with complete satisfaction under the conditions which must be met. Nitro-compounds in the vapor state in conjunction with such a reducing agent as hydrogen are passed over this catalyst at a temperature which may range from 180 to 300 deg. C. The nitro-compound reduced may also be mixed with water gas, other reducing gases, or with an alcohol that is capable of being dehydrogenated under the conditions as indicated suitable for the reduction of the nitro-compound.

The reduction of nitro-benzene to aniline is specifically covered in the patent. Nitro-toluenes can be reduced to toluidines in a similar manner. The catalyst used does not readily become inactivated and when it does it can be restored by superficial reoxidation by heating in air to a high temperature. (1,447,557. March 6, 1923.)

Flattening Sheet Glass—Patents to I. W. Colburn, 1,248,809, dated Dec. 4, 1917, and 1,274,385, dated Aug. 6, 1918, cover an apparatus in which a sheet of glass is drawn upward from a bath of molten glass, bent into a horizontal plane, reheated, and then passed through a drawing mechanism which gives the required longitudinal pull to produce the continuous sheet of glass and at the same time flattens the reheated and softened sheet into its final form. This mechanism has been improved by Seth B. Henshaw, of Charleston, W. Va., through the addition to the draw bars of a series of worms which operate by means of rack and pinion drive to stretch the sheet laterally. The threads of the worms engage the softened thick edges of the sheet, with the result that there is a tendency to stretch the sheet laterally over the whole area engaged by the draw-bars and draw-table. This aids in obtaining a flatter sheet and also tends to draw out wrinkles and waves which may be present. (1,447,661; assigned to Libbey-Owens Sheet Glass Co. March 6, 1923.)

Drawing Sheets of Glass Simultaneously—In the application of Joseph P. Crowley, Serial No. 386,440, filed June 4, 1920, is disclosed a system of drawing sheet glass wherein a pair of sheets are drawn vertically from a bath of molten glass and, after becoming partially set so that they will not adhere to one another, are brought into contact and bent collectively about a single bending roller and then passed through a single drawing mechanism and into the leer. Such a system doubles the output of the sheet drawing apparatus and also has the advantage that a traveling surface of glass (the lower sheet) is interposed between the upper sheet of the pair and the operating portions of the drawing and bending devices so that nothing encounters this upper sheet to mar its surface.

The present invention is an addition to and improvement upon the sheet glass drawing system set forth in this Crowley application. In the present system the sheets are drawn as before in separable contact with one another, but as they enter the leer, mechanism is provided whereby the sheets are separated and conveyed individually through the leer, from which they emerge onto individual cutting tables. In this way both surfaces of each sheet are exposed throughout the travel of the sheet through the leer, thus obtaining more uniform and satisfactory annealing. Also since each sheet emerges separately onto its own cutting table the process of severing the respective sheets into suitable lights or sections is greatly facilitated. (1,447,654. Arthur E. Fowle, of Toledo, Ohio, assignor to the Libbey-Owens Sheet Glass Co. March 6, 1923.)

Sagger Construction—In the burning of ceramic wares, such as sanitary ware, the molded ware is often of large size and the strain put upon the saggers when several of these are superimposed in the kiln is very great. Consequently the life of these saggers is short, due to cracking, warping or settling in such a way as to cause the ware to deform and become ruined. Sometimes these saggers, which are usually made of burnt clay, last for only one run. Silicon carbide when made into refractory forms (see for example U. S. Pat. 1,042,844) has remarkable mechanical strength even at high temperature. At 1,350 deg. C. the modulus of rupture is approximately 2,200 lb. per sq.in., whereas the corresponding value for fireclay is only about 115 lb. per sq.in. Hence at kiln temperatures a silicon carbide refractory structural member has about nineteen times the resistance to cross breaking that is possessed by a fireclay refractory. For this reason, Frank J. Tone, of Niagara Falls, N. Y., proposes to use silicon carbide plates for reinforcing fireclay saggers. The plates may be of such size and shape as nearly to cover the inside bottom of the sagger, or they may be large enough to form a cover, thus supporting the entire bottom of the sagger above. In this way life of saggers has been prolonged to several hundred runs. (1,448,011. Assigned to the Carborundum Co. March 13, 1923.)

Men in the Profession

Dr. E. F. ARMSTRONG has been nominated to the presidency of the Society of Chemical Industry (London) for a second year of office.

ALBERT V. BLEININGER, ceramic engineer and chemist for the Homer Laughlin China Co., Newell, W. Va., gave an interesting address before the members of the Rotary Club, East Liverpool, Ohio, April 24, on "Manufacture of Optical Glass."

B. E. BROWN, of the Bureau of Plant Industry, Washington, recently visited Freehold and Hightstown, N. J., where he supervised the application of fertilizers in the co-operative experiments being conducted in that state.

R. R. CAMPBELL, vice-president of the American Writing Paper Co., Holyoke, Mass., in charge of production, has resigned.

Dr. G. H. A. CLOWES, chemical director, Eli Lilly & Co., Indianapolis, Ind., was the principal speaker at the meeting of the Indiana Section of the American Chemical Society, April 13, at Indianapolis.

C. R. DELONG, M. G. DONK and E. M. WHITCOMB sailed for Europe from New York on May 3 on the steamer "Mongolia." The party intends to conduct investigations of the cost of producing certain chemicals in Germany, Norway, Holland and Switzerland.

JOHN J. EVANS, general manager of the Lancaster, Pa., plant of the Armstrong Cork Co., has been elected president of the Lancaster Chamber of Commerce.

ALEX. L. FEILD, of the Union Carbide & Carbon Research Laboratories, delivered an instructive and interesting lecture on metallography before the senior class of the Cooper Union Night School on April 23.

Dr. KUNO B. HEBERLEIN returned the latter part of April from a business trip in Europe.

Dr. L. O. HOWARD, chief of the Bureau of Entomology, according to word from Holland, has been made honorary president of the International Conference of Phytopathologists and Economic Entomologists, which is to be held June 24 at Wageningen, Holland. Dr. Howard sailed for Europe May 5. While abroad he will attend the International Congress of Agriculture at Paris, May 22 to 26, and the International conference concerning *Dacus oleæ* to be held at Madrid June 18. He will visit entomological institutions in England, France, Italy, Spain, Belgium and Holland, and will consult with many experts concerning the entomological exchange of living beneficial parasites of injurious insects.

Dr. ALBERT W. HULL, scientist in the research laboratory of the General Electric Co., Schenectady, N. Y., has been awarded the Howard N. Potts gold medal for scientific research by the Franklin Institute, Philadelphia. The award was made for his studies in the crystalline structure of matter by means of X-rays and was based on a paper entitled "Crystal Structures of Common Elements" read before the Franklin Institute last year. The Potts medal was established in 1906 from a trust fund left by the will of H. N. Potts of Philadelphia. It is awarded for "distinguished work in science or the mechanic arts."

FORREST K. PENCE, ceramic engineer, has resigned as head of the research department of the Knowles, Taylor & Knowles Co., East Liverpool, Ohio, manufacturer of pottery, to become president and general manager of the Paducah Pottery Co., Paducah, Ky. R. V. MILLER, formerly of the ceramic department, Ohio State University, Columbus, Ohio, will succeed Mr. Pence at the Knowles plant.

G. W. ROBINSON, head of the department of agricultural chemistry, University College, Bangor, North Wales, recently visited the Department of Agriculture, Washington, to learn something of the research work being done in soil physics in the United States. Professor Robinson, who holds a traveling fellowship from the Wales university, plans to spend 2 months studying the experimental work in soil physics at state experiment stations in Georgia, Texas, Arizona, California, Utah, Kansas, Illinois, Michigan, New York, Massachusetts and New Jersey.

Dr. J. J. SKINNER, of the Bureau of Plant Industry, has returned to Washington from Fayetteville and New Bern, N. C., where he supervised the application of fertilizers in the co-operative experiments and inaugurated fertilizer experiments with cotton.

E. W. TREND, representing the mines and chemical works of the Mount Lyell Mining & Railway Co., Ltd., Melbourne, Australia, is a visitor in the United States on business and is making his headquarters at the Chemists' Club, New York City, for several weeks.

Obituary

WILLIAM BRADY, chief chemist and chemical engineer, South Chicago plant, Illinois Steel Co., died on April 22. He was active in chemical circles in the Chicago district, having served as chairman of the Chicago Section of the A.C.S. in 1905, as councilor from 1909 to 1917 and as director from 1913 to 1916. He was also a member of the Chicago Chemists Club, American Electrochemical Society, A.S.T.M. and A.A.A.S.

Calendar of Coming Society Meetings

AMERICAN ASSOCIATION OF CEREAL CHEMISTS will hold its ninth annual convention at Hotel Sherman, Chicago, June 4 to 9.

AMERICAN ASSOCIATION OF ENGINEERS will hold its annual convention in Norfolk, Va., May 7 to 9.

AMERICAN ELECTROPLATERS SOCIETY will hold its eleventh annual meeting at Providence, R. I., July 2 to 5.

AMERICAN GAS ASSOCIATION will hold its annual convention the week of Oct. 15 at Atlantic City. An elaborate exhibition of gas-making and gas-utilization equipment is planned.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its summer meeting June 20-23 at Wilmington, Del.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its twentieth annual convention at the Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its spring meeting May 28 to 31 in Montreal, Canada.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday, June 25, 1923, and ending either Friday or Saturday of that week.

AMERICAN ZINC INSTITUTE, INC., will hold its fifth annual meeting at the Hotel Chase, St. Louis, May 7 and 8.

ASSOCIATED COOPERAGE INDUSTRIES OF AMERICA will hold its eighth annual meeting May 8 and 9 in St. Louis, Mo. Headquarters will be the Jefferson Hotel.

CANADIAN INSTITUTE OF CHEMISTRY will hold its annual meeting in Toronto, May 29 to 31.

CHAMBER OF COMMERCE OF THE UNITED STATES will hold its eleventh annual meeting in New York May 7 to 11.

NATIONAL ASSOCIATION OF MANUFACTURERS OF THE UNITED STATES OF AMERICA will meet in annual conference May 14 to 16, inclusive, at the Waldorf-Astoria, New York City.

IRON AND STEEL INSTITUTE (London) will hold its annual meeting May 10 and 11 at the House of the Institution of Civil Engineers, London, S. W. 1.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH) will be held in New York Sept. 17-22.

NATIONAL FERTILIZER ASSOCIATION will hold its thirtieth annual convention at White Sulphur Springs, W. Va., the week of June 11.

NATIONAL LIME ASSOCIATION will hold its fifth annual convention at the Hotel Commodore, New York City, June 13 to 15.

NATIONAL SYMPOSIUM ON COLLOID CHEMISTRY will be held at the University of Wisconsin, June 12 to 15.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

PACIFIC DIVISION, American Association for the advancement of Science, will hold its seventh annual meeting at the University of Southern California, Los Angeles, Sept. 17 to 20, in conjunction with the summer session of the national association and a meeting of the Southwestern Division of the National Association.

SOCIETY OF CHEMICAL INDUSTRY, Canadian Section, will meet in Toronto, May 29 to 31.

SOCIETY FOR STEEL TREATING — Eastern sectional meeting will be held June 14 and 15, in Bethlehem, Pa.

The following meetings are scheduled to be held in Rumford Hall Chemists' Club, East 41st St., New York City: May 11—Société de Chimie Industrielle (in charge) American Chemical Society, American Electrochemical Society, Society of Chemical Industry, joint meeting, May 18—Society of Chemical Industry, regular meeting. June 8—American Chemical Society, regular meeting.

Industry and Trade

Current News and Market Developments

May 7, 1923

CHEMICAL & METALLURGICAL ENGINEERING

Tenth Avenue at 36th Street, New York

H. C. PARMELEE, *Editor*

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The Summary of the Week

F. E. Breithut appointed chemical trade commissioner for the Department of Commerce, to be stationed in Berlin.

Report from Rome states that, according to American-Sicilian sulphur agreement, world's consuming requirements will be apportioned among producers.

Standards of strength for coal-tar dyes are specifically defined in list emanating from Washington. The standards, when adopted, will be used as a basis for levying import duties.

Acetic acid has been marked up in price, following the recent advance in acetate of lime.

There were offerings of Indian linseed, c.i.f. New York, at a price only 15c. per bushel higher than the prevailing quotation for Argentine linseed. This indicates that the United States may import from India.

Another advance in price was registered in the market for tartaric acid. Frequent price advances have failed to check buying interest.

Tin bichloride and tin crystals are offered at lower prices for May delivery. The decline resulted from lower producing costs as represented by declines in the metal.

Prices for pure spirits of turpentine show a decline of 12c. per gal. for the week. New production is coming in, and demand both at home and for export has been quiet.

Red prussiate of potash sold off sharply during the week. This was due to eagerness of holders to unload.

Arrivals of nitrite of soda from foreign markets were pressed for sale and market prices were forced downward.

Why Produce Synthetic Phenol?

AT THE moment phenol is probably the most interesting commodity on the chemical market. A shortage not entirely anticipated by the consuming industries has recently sent prices skyward. Spot market quotations have risen 65 per cent in 2 months and over 400 per cent during the past year. Naturally contracts have been made at somewhat lower prices, but the figure of 28c. per lb., reported for some recent business, is more than double the manufacturers' prices of a year ago. As one of the results of this situation synthetic phenol works that have been closed down since 1919 are planning to resume production, while the construction on at least one new synthetic plant is already nearing completion.

The question is asked: Why is it necessary to make phenol synthetically? Is not the present record-breaking production of byproduct coke making available greater supplies of coke-oven tar than ever before in history? It is true, to be sure, that the output of byproduct coke in March was three and a quarter million tons, or nearly 50 per cent more than the average monthly output during any previous year and that 1923 will undoubtedly set a new record for the industry. But this does not necessarily mean that the output of phenol will increase in that proportion. Our supply of phenol is determined by the amount of tar that is distilled—not by the amount that is made. During the past year the shortage of both transportation and coal caused an increased quantity of tar to be burned as fuel in steel plants and gas works. Thus the quantity of tar which could be handled profitably by the tar distiller was considerably restricted.

The 1922 output of natural phenol —estimated between a million and a million and a half pounds—was practically all that could be produced under the circumstances. Furthermore, the consumers got little relief from imports, for the high duties of the tariff act of 1922 have proved practically prohibitive.

In 1918, it will be recalled, because of war demands we had an enormous output of phenol (106,794,277 lb.), which was made almost entirely in synthetic phenol plants. At the time of the armistice the government's surplus stocks amounted to 35,000,000 lb., or nearly three times the normal annual consumption. As this surplus found its way to the market, prices declined sharply—falling from 40c. per lb. to less than 10c. per lb. — although early in 1920 the market recovered to about 15c. Production during 1920 and 1921 was practically nil, and in the latter year the reported sales amounted to only 292,645 lb. The market was considerably depressed during these 2 years and it was not until the last quarter of 1922 and the enactment of the new tariff that the present movement had its beginning.

In the U. S. Tariff Commission's "Census of Dyes and Coal-Tar Chemicals" for 1919 the following was said of the phenol situation:

> It is probable that the present and future consumption of phenol will be in excess of the amount of natural phenol obtained from coal-tar distillates, and that when the surplus stocks have been consumed some of the synthetic plants will necessarily resume production.

Present developments, it would seem, form a striking confirmation of this prediction.

Tentative Standards Evolved for Coal-Tar Dyes in Import Trade

Duties Will Be Levied According to These Standards of Strength—Producers and Importers Invited to Criticise List

A TENTATIVE list of standards of strengths of coal-tar dyes in ordinary use in the United States prior to July 1, 1914, has been issued by the Customs Division of the Treasury Department. Copies have been sent to prominent producers and importers for criticism. Suggestions received by May 7 will be given consideration in the final draft of the list, according to the announcement of Director Ernest W. Camp.

About 100 dyes are named in the list. Others are to be classified according to their characteristics corresponding to some one dye in the list. The new tariff act provides that coal-tar products when imported be assessed for duty on the basis of the strength in ordinary use prior to July 1, 1914. Many dyes and chemicals now are imported in more concentrated forms. In such cases, the specific duty of 7 cents per pound will be multiplied in proportion to the increase in strength. The lowest commercial strength in ordinary use prior to the outbreak of the war in Europe is taken as the basis.

The announcement of the Customs Division accompanying its tentative list makes it plain that because a certain dye is chosen as a standard of strength it is not necessarily meant that this particular dye is the best or purest of the class, although its dyeing properties have been taken into consideration. This announcement is to forestall possible efforts to capitalize inclusion in the standard strength list for advertising purposes.

Supplemental lists of such dyes as have been determined to fall within the class corresponding to each standard will be issued in the future.

Following is the announcement of the Customs Division, together with the tentative list:

TREASURY DEPARTMENT,
May ——, 1923.

To Officers of the Customs and Others Concerned:

Attention is invited to the following proviso of paragraph 28, tariff act of 1922: "That in the enforcement of the foregoing provisos in this paragraph the Secretary of the Treasury shall adopt a standard of strength for each dye or other article which shall conform as nearly as practicable to the commercial strength in ordinary use in the United States prior to July 1, 1914; that if a dye or other article has been introduced into commercial use since said date, then the standard of strength for such dye or other article shall conform as nearly as practicable to the commercial strength in ordinary use; that if a dye or other article was or is ordinarily used in more than one commercial strength, then the lowest commercial strength shall be adopted as the standard of strength for such dye or other article."

Pursuant to the foregoing provisions of law standards of strength are hereby adopted as follows:

Calendar

The following important technical meetings are scheduled for the immediate future:

AMERICAN ZINC INSTITUTE
St. Louis, May 7-8

AMERICAN ASSN. OF ENGINEERS
Norfolk, May 7-9

AMER. SOCIETY MECHANICAL ENGRS.
Montreal, May 28-31

CANADIAN INSTITUTE OF CHEMISTRY
Toronto, May 29-31

SOCIETY OF CHEMICAL INDUSTRY
Canadian Section
Toronto, May 29-31

AMER. ASSN. CEREAL CHEMISTS
Chicago, June 4-9

AMER. LEATHER CHEMISTS ASSN.
White Sulphur Springs, W. Va., June 7-9

NAT'L FERTILIZER ASSOCIATION
White Sulphur Springs, W. Va., June 11-16

NATIONAL LIME ASSOCIATION
New York City, June 13-15

SOCIETY FOR STEEL TREATING
Eastern Sectional Meeting
Bethlehem, Pa., June 14-15

AMER. INST. CHEMICAL ENGRS.
Wilmington, Del., June 20-23

AMER. SOC. FOR TESTING MATERIALS
Atlantic City, June 25-29

TENTATIVE STANDARDS FOR COAL-TAR DYES IN IMPORT TRADE

Class Similar in Character and Shade to	Mfr.	Standard	Mfr.
Acid Anthracene Red 3 B	(By)	Acid Anthracene Red 3 B M	(Gar)
Acid Green 2 B	(By)	Acid Green G	(Ch)
Acid Milling Yellow G	(S)	Acid Milling Yellow G	(S)
Acid Violet 4 B N	(B)	Acid Violet 4 B N	(B)
Acid Violet 6 B N	(B)	Acid Violet 6 B N	(B)
Algol Yellow 3 G	(By)	Algol Yellow 3 G single (12½%) paste	(By)
Alizarine Blue Black B	(By)	Alizarine Blue Black B	(By)
Alizarine Blue Black 3 B	(By)	Alizarine Blue Black 3 B	(By)
Alizarine Cyanine N S	(By)	Alizarine Cyanine N S	(By)
Alizarine Cyanine Green G Extra	(By)	Alizarine Cyanine Green C G	(Ch)
Alizarine Cyanine Green 3 G	(By)	Alizarine Cyanine Green 3 G	(By)
Alizarine VI Extra Pure 20% Paste	(B)	Alizarine VI Extra Pure 20% Paste	(B)
Aniline Yellow	(B)	Martius Yellow	(A)
Anthracene Acid Brown G	(C)	Pontachrome Brown G	(Dup)
Anthracyanine Brown G L	(By)	Anthracyanine Brown G L A	(Gras)
Auramine O	(B)	Auramine II	(B)
Benzo Fast Black L	(By)	Pontamine Fast Black L N	(Dup)
Benzo Fast Blue 4 G L	(By)	Benzo Fast Blue 4 G L	(By)
Benzo Fast Orange S	(By)	Pontamine Fast Orange S	(Dup)
Benzo Fast Pink 2 B L	(By)	Pontamine Fast Pink B L	(Dup)
Benzo Fast Red 8 B L	(By)	Benzo Fast Red 8 B L	(By)
Benzo Fast Scarlet 2 B L	(By)	Benzo Fast Scarlet 2 B L	(By)
Benzo Fast Scarlet 5 B L	(By)	Benzo Fast Scarlet 5 B L	(By)
Benzo Rhoduline Red B	(By)	Benzo Rhoduline Red B	(By)
Brilliant Acridine Orange A	(DH)	Brilliant Acridine Orange	(DH)
Brilliant Benzo Fast Yellow G L	(By)	Brilliant Benzo Fast Yellow G L	(By)
Brilliant Crocein M	(C)	Brilliant Crocein M	(C)
Brilliant Fast Blue B	(By)	Brilliant Fast Blue B	(By)
Brilliant Milling Blue B	(C)	Brilliant Milling Blue B	(C)
Brilliant Pure Yellow 6 G Extra	(By)	Brilliant Pure Yellow 6 G Extra	(By)
Brilliant Wool Blue F F R Extra	(By)	Brilliant Wool Blue F F R Extra	(By)
Chinoline Yellow (various marks)	(Var)	Quinoline Yellow 100%	(NA)
Chloramine Yellow 2 G	(By)	Thiazol Yellow 2 G M	(Gar)
Chrome Acetin Blue	(DH)	Chrome Acetin Blue	(DH)
Chrome Brown R V V	(G)	Chrome Brown R V V	(G)
Chrome Printing Red B	(DH)	Chrome Printing Red B	(DH)
Chrome Violet CG	(DH)	Chrome Violet C G	(DH)
Chromoxane Brilliant Blue G	(By)	Chromoxand Brilliant Blue G	(By)
Chrysamine G	(By)	Chrysamine G	(By)
Chrysamine R	(By)	Chrysamine R	(By)
Ciba Blue 2 B	(J)	Ciba Blue 2 B D (16%) Paste	(Dow)
Coriphosphine O	(By)	Coriphosphine O	(By)
Cyanol F F	(C)	Cyanol F F	(C)
Deltapurpurine 5 B	(By)	Deltapurpurine 5 B	(By)
Diamine Catechin G	(C)	Pontamine Catechu G	(Dup)
Diamine Fast Blue F F B	(C)	Diamine Fast Blue F F B	(C)
Diamine Fast Red 8 B L	(C)	Benzo Fast Red 8 B L	(By)
Diamine Rose G D	(C)	Diamine Rose G D	(C)
Diamine Sky Blue F F	(C)	Direct Sky Blue F F	(Newp)
Dianil Fast Scarlet 8 B S	(M)	Pontamine Fast Pink G	(Dup)
Diazo Sky Blue 3 G	(By)	Diazo Sky Blue 3 G	(By)
Diazo Geranine B Extra	(By)	Diazo Geranine B Extra	(By)
Diphenyl Brown G S	(G)	Direct Brown R C	(Newp)
Diphenyl Fast Brown G N C	(G)	Diphenyl Fast Brown G N C	(G)
Eclipse Brown 3 G K	(G)	Sulphogene Yellow D	(Dup)
Erika B	(A)	Erika B	(A)
Eriechrome Black E	(G)	Alizarole Black 3 G	(NA)
Erythrosin B	(C)	Erythrosin N blue shade	(H. & M.)

Argentina Imports American Printing Ink

Argentine requirements for printing and lithographic inks reaches 1,000,000 lb. annually, of which 80 per cent is imported from the United States. The business is largely in the hands of a few houses that import the ink in barrels and rework it in local shops. Some ink is imported prepared in cans, but this is not considered as successful nor as economical a method as to import in bulk, since the saving of about 5 cents a pound in import duties on ink imported in bulk more than pays for the cost of reworking and packing. The journey through the tropics also affects the prepared ink, and it is therefore possible to supply the consumer with a superior and more uniform product when it is prepared for the market in Buenos Aires. One American manufacturer, with a factory in Buenos Aires, has the bulk of the trade, and by personal work has captured a market which was formerly in the hands of German and French firms.

Linseed Exports From India

Shipments of linseed from India for the crop year ended March 31 reached the total of 10,596,000 bu. The United Kingdom was the principal buyer, taking 5,944,000 bu. The Continent absorbed 4,652,000 bu. The new crop situation is favorable and the exportable surplus for the 1923-24 season is estimated by shippers at 12,000,000 bu.

TENTATIVE STANDARDS FOR COAL-TAR DYES IN IMPORT TRADE (Continued)

Fast Acid Violet A 2 R	(M)	Fast Acid Violet A 2 R	(M)
Fast Light Yellow 3 G	(By)	Fast Light Yellow G 3 X	(Phar)
Fast Mordant Yellow G	(B)	Alizarine Yellow 2 G	(Gras)
Guinea Fast Red B L	(A)	Guinea Fast Red B L	(A)
Helindone Pink A N	(M)	Helindone Pink A N single (10%) Paste	(M)
Helindone Pink B N	(M)	Helindone Pink Single (10%) Paste	(M)
Hydren Blue G	(C)	Hydren Blue G Single (20%) Paste	(C)
Hydren Blue R	(C)	Hydren Blue R Single (20%) Paste	(C)
Indanthrene Black BB	(B)	Anthrene Black B Single (12½%) Paste	(Newp)
Indanthrene Blue B C S	(B)	Anthrene Blue B C S Single (20%) Paste	(Newp)
Indanthrene Blue G C	(B)	Anthrene Blue G C Single (10%) Paste	(Newp)
Indanthrene Blue G C D	(B)	Antarene Blue G C D Single (8½%) Paste	(Newp)
Indanthrene Blue 3 G	(B)	Ponsol Blue 3 G Single (10%) Paste	(Dup)
Indanthrene Blue 5 G (new)	(By)	Algol Blue 3 G (old) Single(12½%) Paste	(By)
Indanthrene Blue R E Z	(B)	Indanthrene Blue R E Z	(B)
Indanthrene Blue R S	(B)	Anthrene Blue R S Single (10%) Paste	(Newp)
Indanthrene Blue R S P	(B)	Ponsol Blue R P Single Paste	(Dup)
Indanthrene Brilliant Violet 2 BK (new)	(By)	Algol Bril. Violet 2 B (old) Single (12½%) Paste	(By)
Indanthrene Brilliant Violet 2R (new)	(B)	Indanthrene Violet 2 R Extra Single (12½%) Paste	(B)
Indanthrene Brown B	(B)	Anthrene Brown 2 B Double (22%) Paste	(Newp)
Indanthrene Brown R (new)	(By)	Algol Brown R (old) Single (12½%) Paste	(By)
Indanthrene Golden Orange G	(B)	Indanthrene Golden Orange G (Single (12½%) Paste	(B)
Indanthrene Golden Orange R	(B)	Indanthrene Golden Orange R Single (12½%) PST	(B)
Indanthrene Orange RRT (new)	(B)	Indanthrene Golden Orange RRT (old) single (20%) Paste	(B)
Indanthrene Yellow G	(B)	Anthrene Yellow G Single (12½%) Paste	(Newp)
Indanthrene Yellow G K (new)	(By)	Algol Yellow R Single (12½%) Paste	(By)
Indigo MLB/2B	(M)	Midland Vat Blue R Single (20%) Paste	(Dow)
Katigen Green 2 G	(By)	Katigen Green 2 G	(By)
Light Green S F Yellowish	(M)	Pentacyl Light Green S F Yellowish	(Dup)
Methylene Blue 2 B	(By)	Methylene Blue 2 B	(By)
Neptune Blue B	(B)	Neptune Blue B	(B)
Neptune Blue B G	(B)	Neptune Blue B G	(B)
Oxamine Black B H N	(B)	Oxamine Black B H N	(B)
Para Sulphon Brown V	(S)	Para Sulphon Brown V	(S)
Patent Marine Blue	(M)	Patent Marine Blue	(M)
Polar Yellow 2 G Conc	(G)	Polar Yellow 2 G Conc	(G)
Pyrazol Orange 2 R	(S)	Pyrazol Orange 2 R	(S)
Pyrazol Orange R	(S)	Pyrazol Orange R	(S)
Resorcin Brown F	(K)	Resorcin Brown F	(K)
Rhodamine B	(B)	Rhodamine B	(B)
Rhoduline Blue 3 G O	(By)	Rhoduline Blue 3 G O	(By)
Rhoduline Sky Blue 3 G	(By)	Rhoduline Sky Blue 3 G	(By)
Silver Grey P	(A)	Silver Grey P	(A)
Sulphon Yellow B G	(By)	Sulphon Yellow B G	(By)
Supramine Red B	(By)	Supramine Red B	(By)
Supramine Red 2 G	(By)	Supramine Red 2 G	(By)
Thio Chromorhodine B R	(DH)	Thio Chromorhodine B R	(DH)
Thional Brown G	(S)	Thional Brown G	(S)
Thio Violet 5 R	(DH)	Thio Violet 5 R	(DH)
Trisulphon Brown B	(S)	Trisulphon Brown B	(S)
Xylene Light Yellow R	(S)	Xylene Light Yellow R	(S)
Zambesi Black D	(A)	Diazine Black D R	(NA)

KEY TO ABBREVIATIONS

(A)	Actien-Gesellschaft, Berlin, Germany	(Gras.)	Grasselli Chemical Works, U.S.A.
(B)	Badische Co., Germany	(H & M)	Heller & Merz, U. S. A.
(By)	Bayer & Co., Germany	(J)	Gesellschaft für Chemische Industrie, Switzerland
(C)	Casella & Co., Germany		
(Ch)	Chemical Co. of America, U.S.A.	(K)	Kalle & Co., Germany
(DH)	Durand & Huguenin, Switzerland	(M)	Meister Lucius & Brüning, Germany
(Dow)	Dow Chemical Co., U.S.A.	(NA)	National Aniline & Chemical Co., U.S.A.
(Dup)	Dupont Chemical Works, U.S.A.	(Newp)	Newport Chemical Works, U.S.A.
(G)	Geigy & Co., Switzerland	(Pnar)	Pharma Chemical Corporation, U.S.A.
(Gar)	Garfield Aniline & Chemical Works, U.S.A.	(S)	Sandoz Chemical Works, Switzerland
(Var)	Various		

In selecting the standards set forth in the foregoing list the main consideration has been the choosing of that dye which corresponds in strength as nearly as practicable to the lowest commercial strength of the given class, in conformity with paragraph 28 of the tariff act of 1922. The fact that a certain dye is chosen as a standard does not necessarily mean that that particular dye is the best or purest of the class, although its dyeing properties have of necessity been taken into consideration.

It is the intention of the department to issue from time to time supplementary lists of such dyes as have been determined to fall within the class corresponding to each standard adopted.

Would Make Goldsmith Chief Tariff Investigator

The long-vacant post of chief foreign investigator for the United States Tariff Commission is to be filled soon. It has recently been learned that the commission is agreed upon Alan Goldsmith, now chief of the Western European Division of the Bureau of Foreign and Domestic Commerce of the Department of Commerce as the man for the work. Mr. Goldsmith is expected to return soon from Rome, where he represented the Department of Commerce at the recent meeting of the International Chamber of Commerce.

At the present time the commission has two representatives in Europe. Chairman Marvin, it is known, has been advised by them that great difficulty may be expected by the investigators who are seeking data upon which to base recommendations for changes in the tariff rates. In France, especially, it is said that manufacturers are openly hostile to these inquiries, being unwilling to open up their books and let the investigators learn what it costs them to produce the commodities which are exported to the United States. Some offers of co-operation have been made in Germany.

The foreign investigations naturally are not expected to get well under way until a directing head is chosen. For more than a year the office has been unfilled and the commissioners have been apparently unable to unite upon one man. However, it is understood that Mr. Goldsmith was quite acceptable to all the commissioners.

War Gases Cure Disease

Recent Experiments Show That Influenza, Tuberculosis and Paresis Are Benefited by Treatment

To cure rather than to kill is the most modern use of the so-called poison gases. Experts of the Chemical Warfare Service believe that the possibility of successfully treating influenza, tuberculosis, paresis and other afflictions by the use of poison gases has been demonstrated by experiments now being conducted at Edgewood Arsenal.

It is asserted that through experiments with chlorine gas, the chemists have established the fact that epidemics of grip and colds may be checked almost instantly by the introduction of weak concentrations of the gas into the rooms occupied by those exposed.

Mustard Gas for Tuberculosis

That mustard gas is a specific for tuberculosis apparently seems to be demonstrated by the experiments conducted under the direction of Lieutenant-Colonel E. B. Vedder of the Army Medical Corps. Guinea pigs inoculated with tuberculosis germs and a concentration of mustard gas were apparently rendered immune by the gas and failed to contract the disease. An equal number of guinea pigs inoculated with tuberculosis germs and not subjected to the mustard gas treatment contracted the disease.

Experiments With Lewisite

As a result of experiments with lewisite, the chemists have evolved what appears to be a remedy, if not a cure, for paresis and locomotor ataxia.

Dr. A. S. Loevenhart of the University of Wisconsin has been studying the effects of lewisite upon the human system in conjunction with the chemists at Edgewood Arsenal. He has the records of forty-two persons committed to insane hospitals with paresis, who have come under this treatment. Of that number twenty-one have been cured.

Chlorine as Cold Cure

The fact that chlorine might be used to prevent or cure colds, influenza and pneumonia was demonstrated during the war at Edgewood Arsenal by accident. It was remarked that cases of influenza or pneumonia did not occur among the workers in the laboratory where chlorine was being made, although 10 to 20 per cent of others on duty at the arsenal were victims. Investigation showed that in the rooms where chlorine gas was being made there was a slight leakage of chlorine, just enough to act as a germicidal agent.

Following out this idea, the Chemical Warfare Service and the Medical Department have made great advances on this line and it is now believed practicable to introduce small quantities of chlorine into school rooms, factories, churches and other places where persons gather.

Testing Materials Meeting Plans Announced

Society's Twenty-sixth Annual Session to Have a Program Replete With Committee Reports and Papers

The twenty-sixth annual meeting of the American Society for Testing Materials is to be held at Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. The program promises to be very complete. Besides the reports of about thirty-five committees several special papers are to be read. Some of the features of the meeting are as follows:

Metals — The Endurance of Metals Under Repeated Stresses is discussed in two papers, one devoted primarily to steel and the other to duralumin and manganese bronze. The work of the Bureau of Standards in the study of Gases in Steel is described. There will be a discussion on the desirability of including Chemical Requirements in Cast-Iron Specifications. A further report on Effect of Sulphur in Steel will be presented by the joint committee on that subject.

Concrete and Reinforced Concrete—The outstanding feature is a discussion (to which an entire session will be devoted) on the topic "What Properties of and Methods of Making Concrete Require Further Investigation?" Slag as an Aggregate in Concrete is discussed in one paper; Fatigue of Concrete in another; and there are two papers on the use of Calcium Chloride in Concrete.

Consistency—This subject has long been a troublesome one. A paper by the sub-committee on consistency will record the various conceptions of consistency and methods of test developed by the several committees, and the whole discussion will be introduced by a paper treating with fundamental considerations involved in this property of materials.

Slate — The program contains two papers on this subject, which will be discussed at an A.S.T.M. meeting for the first time.

Glue—A comprehensive discussion on "The Testing of Glue" has been arranged at the request of a number of glue chemists and large users of glue. This is an important matter in many industries.

Testing—The entire meeting is replete with valuable papers and reports on methods of testing, covering such topics as babbitt metal, magnetic properties, tool steels, insulating varnishes, paints, concrete, etc. There are also included descriptions of new devices in extensometers, an accelerometer for measuring impact, and a new machine for testing textiles.

Chicago Lard Stocks Gain

Stocks of lard in Chicago increased 20,717,000 lb. in the past month. The stocks on May 1 were estimated at 34,212,000 lb., which compares with 13,495,000 lb. on April 1 and 45,147,000 lb. on May 1 a year ago.

Agreement Between American and Italian Producers of Sulphur

Prices Will Be Fixed From Time to Time—American Production to Supply Demands of North America—World Consumption Apportioned

IN A REPORT dated March 27, Consul H. Earle Russell of Rome, Italy, gives interesting details of the agreement recently made by American and Sicilian producers of sulphur. Mr. Russell states that the essential points of the accord concern the determination of the sales prices and the designation of the quantities to be placed by each of the contracting parties.

Prices will be fixed from time to time with reference to the conditions in the individual consuming countries, and in such a manner as to reach gradually the pre-war level.

By agreement made at the time of signing the accord, prices have on the average been increased by more than one dollar per ton over those provisionally determined in October, 1922.

Division of Markets

With regard to the division of markets, it has been decided that the American production shall supply the demands of North America, while the Italian product will be reserved for the national needs. The remaining world consumption will be met in determined proportions by America and Sicily, to the latter being given the exclusive right of sale up to 65,000 tons for the manufacture of sulphuric acid in any country. On the basis of the approximate figures of the present world consumption, it is calculated that Sicily will be able to export annually about 145,000 tons of raw and worked sulphur, in addition to the 65,000 tons destined for the manufacture of sulphuric acid. These quantities are considerably greater than those exported by Italy in the last few years.

The exportation of raw sulphur to individual markets will then be regulated, taking into account as far as possible the advantages accruing to each of the contracting parties from their geographical position in relation to the various consuming countries. The exportation of worked sulphur remains entirely unfettered. The contracting parties are pledged to maintain the present situation in the industry of refining and grinding of sulphur, which represents a guarantee for the Italian production of worked sulphur.

Agreement Holds Until 1926

The duration of the agreement is fixed until Sept. 30, 1926, and may be prolonged. It is, however, proper for the parties to denounce the convention even before the above date by a notice from one to the other of not less than 6 months. However, it is arranged that the rupture of the agreement will not take place during the sulphur selling season.

There is also created a central office in London with representatives of both parties for the exchange of data, information and statistics, and for the maintenance of a closer contact between the parties themselves in regard to the execution of the agreement.

Settlement of Disputes

Each dispute that may arise over the same will be submitted to the judgment of a board of arbitration with headquarters in London, composed of a representative of each of the parties and of a third named by the first two, or, in default thereof, by the president of the Chamber of Commerce.

The agreement is viewed with much jubilation by the Sicilian producers, who consider it of great importance to the sulphur industry as giving to it a period of recuperation and relative tranquillity necessary to cure the evils of the recent past and to provide for a better system and organization.

General Reduction in German Export Duties

A general abolition or reduction in the German export duties became effective April 29, according to a cablegram of that date, received at the Department of Commerce from Commercial Attaché Charles E. Herring at Berlin. It is stated that owing to the heavy decrease in export orders since February and to high prices this measure has been deemed necessary.

It is also reported that German manufacturers and wholesalers, with the exception of the clothing industry, are generally in favor of abolishing the export control boards, which are known in German as the "Aussenhandelsstelle."

Personals

Jerome Rockhill, son of the late Clayton Rockhill, has joined the staff of Julian W. Lyon & Co., importers and dealers in essential oils in New York.

M. F. Austin, manager of the vegetable oil department of J. C. Francesconi & Co., has returned from a business trip to points in New England.

William L. Greenbaum has been appointed receiver for the Kemiko Co., disinfectants, 426 Broome St., New York. Liabilities are placed at $4,295; assets about $2,000. The company is incorporated under the laws of New Jersey with authorized capital of $25,000.

Major Breithut Appointed Chemical Trade Commissioner at Berlin

Has Had Broad Experience in Chemical Industries and Unusual Background in Chemical Economics—Widely Known for Work in Chemical Warfare Service and War Industries Board

THE significance of the German chemical industry in its relation to our own developments has led the U. S. Department of Commerce to appoint Dr. F. E. Breithut to the staff of Commercial Attaché Herring at Berlin as Chemical Trade Commissioner. In this capacity, Dr. Breithut will be of considerable service to the American industry.

In selecting Dr. Breithut for this post, the Department of Commerce secures the services of a trained chemical economist. During the war he served as an assistant to Herbert Hoover in various food conservation campaigns and was later commissioned as a major in the Chemical Warfare Service. In the latter capacity he was attached to the headquarters staff of Major-General W. L. Siebert, acting first as chief of personnel, then as chairman of the chemicals group, price section, of the War Trade Board, and subsequently as chief of procurement, salvage and sales.

After the armistice, Dr. Breithut spent 4 years in dyestuff and other industrial chemical work, returning to the College of the City of New York last year.

While teaching there Dr. Breithut instituted a course in the economics of the chemical industry. This attracted widespread interest in educational circles and it so impressed the chemical trade that the Salesman's Association of the American Chemical Industry induced Dr. Breithut to give a special evening course particularly adapted to the requirements of its members.

F. E. BREITHUT

The new trade commissioner has contributed several articles to the literature of chemistry, both popular and technical. His technical publications include "Is There an American Dye Monopoly?" "The Economic Status of the American Chemical Industry," and "Prices of Chemicals During the War." More recently he has published "The Inspection of Establishments Producing, Using or Refining Wood Alcohol," and "A New Method of Measuring the Partial Vapor Pressures of Binary Mixtures."

New York Chapter Formed by Institute of Chemistry

The New York Chapter of the American Institute of Chemistry came into being on April 30. On that date about thirty members of the National Institute gathered for dinner and preliminary election of officers for a New York chapter. Dr. R. V. Bacon was made chairman. Dr. A. Naglevoort was elected vice-chairman, Thomas Wright treasurer and C. L. Bryden secretary. At the same time publicity and membership committees were appointed.

The first work to be done in the state of New York is that of classification of chemists according to economic status. To this end it is proposed to make a fact-finding survey concerning the chemists of the entire district. Following this classification a more definite plan of activity will be adopted.

In the meantime the enrollment of properly qualified members is sought. The next meeting of the chapter is to be held on May 28. The hour and place will be announced later.

Dye Importers Contemplate New Association

Several importers of dyes are considering the formation of a separate and distinct organization. What form the new body will take is as yet unannounced. Question exists as to the advisability of affiliating with a national association of importers as a dyestuff group.

Among those mentioned as interested in such a project are William Baur, of Bachmeir & Co.; Mr. Loeffler, of the American Aniline Products Co.; Mr. Rosenthal, of the Ackerman Color Co., and Dr. Pickerall, of Herman A. Metz & Co.

G. C. Davis, former government tariff expert, has been called into consultation by those interested in the plan. Mr. Davis has acted in an advisory capacity in tariff matters for a number of the larger dye houses in New York, and his views are being sought with respect to the problems with which an organization such as is contemplated must cope.

News Notes

Eighty per cent of the dyes consumed in Great Britain are now being produced by the British dye-making industry, according to an analysis of the dyestuffs business in the United Kingdom received recently by the Commerce Department from Consul General Robert P. Skinner, at London.

Another war-time project of Uncle Sam is being offered for sale. Bids on the Norfolk army supply base, covering an area of 900 acres, with terminal improvements, are to be opened on May 22. As a shipping, export and storage base, this area is one of the best located on the Atlantic seaboard.

The quantity of hydrocyanic acid absorbed by a large number of fumigated fruits, vegetables, seeds, flour and other foodstuffs has recently been determined in the Bureau of Chemistry. The results of this work, as well as a brief review of the literature, are to be given in a bulletin, immediately obtainable from the Division of Publications at Washington.

Synthetic apple oil prepared by Dr. F. B. Power and his associate, V. K. Chesnut, of the Bureau of Chemistry, for which a public service patent was granted in 1922, is now being manufactured by a commercial concern in New York. This apple oil possesses the aroma of ripe apples and is the result of a prolonged chemical investigation of their odorous constituents.

Barely 1,000 ounces of platinum constitutes the total production of the United States for 1922. J. M. Hill, of the Geological Survey, points out that the larger part of this was produced in California.

War mineral claims to the number of about 800 have now been settled. This leaves about 400 of the less important ones open to adjustment. Of the $8,500,000 appropriated by Congress 2 years ago, $2,250,000 remains for the remaining settlements, which it is planned may all be made by January, 1924.

Recent specifications that have been submitted to the American Engineering Standards Committee for comment and criticism, prior to their formal adoption by the Federal Specifications Board, include: Steel castings, foundry pig, semi-steel castings, ingot copper, ingot tin, slab zinc and phosphor copper.

Swiss iron foundries are operating in many cases at a loss. The outlook is regarded as extremely dubious due to the cutting off of iron and coal supplies. A rise in prices is considered urgently necessary if activity at these works is to be continued.

The British America Nickel Co. is shortly to resume operations, discontinued two years ago. C. A. Rose of New York is to be general manager of technical operations. The capacity of the plant will eventually be 10,000 tons of nickel a year. Production of other metals, especially copper, will also be carried on.

Coal-Tar Dyes Imported Through Port of New York During April

Detailed Information Compiled by Chemical Section of Commerce Bureau and Tariff Commission

IMPORTS of coal-tar dyes for April totaled 242,022 lb., with an invoice value of $256,751.

The four dyes leading in quantity imported were xylene light yellow, diaminogene blue, patent blue (No. 543) and diazamine blue BR. Of the total quantity imported in April, 1923, 42 per cent came from Switzerland, 37 per cent from Germany, 18 per cent from Italy, 2 per cent from Canada and 1 per cent from England. Switzerland led for the first time in 1923, indicating that the Ruhr occupation has not seriously affected the supply of raw material for dye making in that country. Prior to the war Switzerland depended almost exclusively on Germany for these materials. Official statistics for 1922, however, show that she imported crude and intermediates from France, Great Britain, Poland, Italy, Czechoslovakia, United States and Germany.

The dyes in this report are grouped by Schultz numbers and in the case of those which could not be identified by Schultz number, the classification according to ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single strength basis.

The designation "c" for competitive, and "n. c.' for non-competitive, in column 1 of the report, indicates the appraisement basis for the assessment of the ad valorem duty in paragraph 28 of the tariff act of 1922. Those dyes without designation are doubtful, pending further investigation.

The ad valorem rate for competitive dyes is based on the American selling price, as defined in subdivision (*f*) of section 402 of title IV; the ad valorem rate for non-competitive dyes is based on the United States value, as defined in subdivision (*d*) of section 402 of title IV of the tariff act of 1922. All dyes are listed where imports for the month were 500 lb. or more.

Schultz No.		Name of Dye	Mfr.	Quantity, Lb.	Invoice Value, Dollars	Per Cent By Countries	
9		Direct yellow G		2,002		Switzerland	100
	c.	Sun yellow G	S				
22		Xylene light yellow		12,149		Switzerland	100
		Xylene light yellow R conc.	S				
		Xylene light yellow 2G conc. 75%	S				
28		Hansa Yellow G		500		Germany	100
	n.c.	Hansa yellow G powder 100%	M				
88		Acid anthracene brown		2,757	1,604	Germany	100
	n.c.	Acid anthracene brown PG	By				
	c.	Acid anthracene brown RH extra	By			Germany	100
222		Janus yellow		500		Germany	100
	n.c.	Yellow IG (Janus yellow G)	M				
265		Acid milling black	G	3,969		Switzerland	100
		Acid milling black B652					
273		Diaminogene blue		10,588	7,766	Germany	85
	n.c.	Diaminogene blue NA	C			Italy	15
	n.c.	Blue NA (100% standard)	C				
274		Diaminogene					
	n.c.	Black extra (100% standard)		7,000		Germany	100
		(Diaminogene extra)	C				
319		Diamine scarlet	S	3,002		Switzerland	100
		Chloramine red 3B (standard)					
392		Toluylene orange		1,334	1,133	Switzerland	99
	n.c.	Direct fast orange K	I			Germany	1
	c.	Toluylene fast orange GL	By				
456		Benzo fast blue		1,551	2,401	Germany	50
	n.c.	Benzo fast blue 2GL	By			Italy	50
	n.c.	Benzo fast blue 4GL	By				
494		Auramine G		1,212		Switzerland	100
	n.c.	Auramine G	I				
506		Erioglaucine		1,279		Switzerland	100
	n.c.	Erioglaucine AP 545	G				
527		Acid violet 4BN		4,004		Switzerland	100
	c.	Acid violet 4BNS conc. 6-10	S				
537		Methyl blue for silk		882		Switzerland	100
	c.	Methyl Lyons blue 410	G				
543		Patent blue		14,035	9,458	Germany	100
		Brilliant acid blue V	By				
	c.	Neptune blue BGX conc.	B				
	n.c.	Patent blue V (56%)	M				
	n.c.	Patent marine blue LE	M				
545		Patent blue A		3,449	3,154	Germany	99
		Brilliant acid blue FF	By			Canada	1
	c.	Patent blue A (56%)	M				
	c.	Patent blue A	Q				
553		Eriochrome cyanine		999		Switzerland	100
	n.c.	Eriochrome cyanine R.C. 935	G				
564		Naphthalene green		993		Switzerland	100
		Naphthalene green V	Q				
571*		Rhodamine 6G		3,272	9,364	Switzerland	41
	n.c.	Rosaseine 6G extra (100%)	M			Italy	31
	n.c.	Rhodamine 6G extra (100%)	M			Germany	24
	n.c.	Rhodamine 6G extra (500%)	M			Canada	4
	n.c.	Rhodamine 6GD extra (100%)	M				
	n.c.	Rhodamine 6GD extra (500%)	M				
	n.c.	Rhodamine 6GDN extra	M				
	n.c.	Rhodamine 6GDN extra (500%)	M				
		(52% of the total quantity is 500% strength)					
573		Rhodamine B		3,883	9,195	Switzerland	57
	c.	Rhodamine B extra	I			Italy	30
	c.	Rosaseine B extra (100%)	M			Germany	13
		(Rhodamine B extra)					
	c.	Rhodamine B extra (500%)	I				
		Notes—54% of the total quantity is 500% strength					
609		Homophosphine		2,033	3,548	Germany	100
	n.c.	Auracine G	By				
	n.c.	Corioflavine GOOO (150%)	GrE				
663		New methylene blue		1,100	1,853	Germany	91
	n.c.	New methylene blue NX (100%)	C			Canada	9
	n.c.	Methylene blue N.NX (70%)	B				
759		Anthraflavone (single strength)		2,528	2,025	Italy	100
	n.c.	Anthraflavone GC paste fine	B				
	n.c.	Anthraflavone GC paste	Bl				
	n.c.	Anthraflavone GC powder	B.				
760		Indanthrene golden orange G		4,202	3,551	Italy	85
		(single strength)				France	15
		Indanthrene golden orange G paste	B				
	n.c.	Indanthrene golden orange G double paste	B				
	n.c.	Indanthrene golden orange G double paste fine	B				
	n.c.	Indanthrene golden orange G powder	B				
761		Indanthrene golden orange (single strength)		6,177	7,251	Italy	62
	n.c.	Indanthrene golden orange 2RT paste	B			Germany	17
	n.c.	Indanthrene golden orange 2RT powder	B			Canada	13
	n.c.	Indanthrene golden orange RRTS powder	B			France	8
	n.c.	Helindone golden orange IRRT paste fine (10%)	M				
767		Indanthrene violet RR (single strength)		2,699	2,587	Germany	52
	c.	Helindone violet IRR extra paste (10%)	M			Italy	48
	c.	Indanthrene violet RR extra double paste	B				
794		Cibanone black (single strength)		1,760		Switzerland	100
	n.c.	Cibanone black 2G powder (100%)	S				
795		Cibanone yellow R		6,393		Switzerland	100
	n.c.	Cibanone yellow R paste 10%	S				
799		Alizarin cyanine G		882		Germany	100
	n.c.	Alizarin cyanine 2G powder	By				
820		Algol brilliant violet R (single strength)		3,115	1,716	Italy	100
	n.c.	Algol brilliant violet R paste	By				
	n.c.	Algol brilliant violet R powder	Bv				

Head of Nitrate Survey Named

The nitrate investigation of the government is to be in charge of H. A. Curtis, formerly general manager of the Clinchfield Carbocoal Corporation and during the war connected with the Ordnance Department.

William H. Walker, of Glenn Willows, Calif., was named as assistant head of the nitrate survey. He is a vice-president of the American Farm Bureau Federation and is to take charge of the study of the probable demand for nitrates, chiefly from the agricultural point of view.

The work of the investigation will be carried on in close collaboration with trade and governmental organizations already active in the field.

Potash, according to a statement by Secretary Hoover, probably will be the next chemical commodity to be taken up by the foreign monopoly survey. Thus far Mr. Hoover sees no necessity for an investigation into the Japanese control of camphor production, on the theory that a large part of the product is manufactured synthetically. It is the department's intention, however, to make a study of all raw materials of import upon which this country is dependent and which are produced under foreign monopolies.

Schultz No.	Name of Dye	Mfr.	Quantity, Lb.	Invoice Value, Dollars	Per Cent By Countries	
828	Indanthrene claret B		825		Italy	100
n.c.	Indanthrene Bordeaux B extra paste	B				
838	Indanthrene blue Ra (single strength)		8,097		France	100
	Indanthrene blue RS triple powder for paper	B				
842	Indanthrene blue GCB (single strength)		4,863	2,491	Canada	59
	Indanthrene blue GCD paste	B			Italy	41
c.	Indanthrene blue GCD double paste	B				
c.	Indanthrene blue GCD powder	By				
856	Alizarin astrol		5,101	11,052	England	51
n.c.	Alizarin astrol B powder	By			Italy	43
n.c.	Alizarin rubinol GW	By			France	6
n.c.	Alizarin rubinol GW powder	By				
n.c.	Alizarin rubinol R	By				
n.c.	Alizarin rubinol R powder	By				
n.c.	Alizarin rubinol 3G	By				
858	Alizarin saphirol B		1,336	2,254	Germany	41
	Alizarin blue SAWSA powder	By			Italy	41
c.	Alizarin saphirol	By			France	18
c.	Alizarin saphirol B	By				
c.	Alizarin saphirol WSA	By				
c.	Helio fast blue BL (100%)	By				
862	Alizarin blue black B		4,729	4,023	Germany	62
c.	Alizarin blue black B	By			France	14
c.	Alizarin blue black B (100%)	By			Italy	14
c.	Alizarin blue black B powder (80%)	By				
869	Algol brown B (single strength)		4,492	4,171	Germany	78
n.c.	Algol brown G paste	By			Italy	22
n.c.	Algol brown R paste	By				
n.c.	Algol brown R powder	By				
n.c.	Vat brown R paste	By				
901	Ciba violet B (single strength)		4,845		Switzerland	100
n.c.	Ciba violet B. paste 10%	I				
	Ciba violet B powder	I				
904	Helindone brown G (single strength)		980		Italy	100
n.c.	Thio indigo brown G powder	K				
907	Ciba scarlet		3,981	3,874	Switzerland	75
n.c.	Ciba scarlet G extra paste (20%)	I			Germany	25
n.c.	Helindone fast scarlet C paste (17%)	M				
910	Helindone pink		5,043		Italy	59
n.c.	Helindone pink AN (10%) paste	M			Germany	41
913	Helindone orange R (single strength)		3,400	2,222	Germany	67
n.c.	Helindone orange R powder	M			Italy	33
n.c.	Helindone orange R powder (100%)	M				
918	Helindone red 3 B		2,000		Germany	100
n.c.	Helindone red 3 B paste (20%)	M				
919	Ciba Bordeaux B		551		Switzerland	100
n.c.	Ciba Bordeaux B paste (10%)	I				
	Acid alizarin gray G		1,785	3,012	Germany	56
n.c.	Acid alizarin gray G	M			Italy	24
n.c.	Acid alizarin gray G (80%)	M			France	12
n.c.	Acid alizarin gray G (100%)	M			Canada	8
c.	Alizarin light blue B conc	S	2,286		Switzerland	100
c.	Azo wool violet 7R (Standard 100%)	C	500		Germany	100
n.c.	Polar orange R conc. 599	G	999		Switzerland	100
c.	Scarlet 2 R (Standard not conc.)	S	500		Switzerland	100
n.c.	Wool fast yellow 3G (80%)	B	560		Germany	100
	Unidentified Vat Dyes					
	Helindone pink		7,366	6,907	Germany	68
n.c.	Helindone pink B extra paste	M			Italy	32
n.c.	Helindone pink B extra paste (10%)	M				
n.c.	Helindone pink R extra paste	M				
n.c.	Helindone pink R extra paste (10%)	M				
	Hydron pink		2,747	2,993	Germany	72
	Hydron pink FB paste	C			Italy	28
n.c.	Hydron pink FF paste	C				
	Hydron scarlet		1,213		Switzerland	82
n.c.	Hydron scarlet 2B paste	C			Italy	18
n.c.	Thio indigo pink RN paste	K	891		Italy	100
	Thio indigo violet 2R paste	K	914		Italy	100
	Unidentified Mordant and Acid Chrome Dyes					
c.	Anthracene chromate brown EB	C	1,500		Germany	100
	Chromorhodine		991	3,335	Switzerland	100
	Chromorhodine BN powder	DH				
	Chromorhodine BR powder	DH				
n.c.	Eriochrome flavine A conc	G	1,764		Switzerland	100
n.c.	Eriochrome red G	G	1,100		Switzerland	100
n.c.	Metachrome blue black 2 BX	A	4,000		Germany	100
	Modern royal blue powder	DH	661		Switzerland	100
	Omega chrome brown		1,190	1,145	Switzerland	100
	Omega chrome brown G conc	S				
	Omega chrome brown PB conc	S				
	Unidentified Direct Dyes					
	Chlorantine brown Y	I	2,205		Switzerland	100
c.	Chlorantine fast yellow 4 GL	I	1,102		Switzerland	100
	Diamine catechine		3,186	3,194	Switzerland	97
c.	Diamine catechine B (100%)	C			Germany	3
c.	Diamine catechine GR (200%)	I				
	Diamine fast orange		1,781	1,615	Italy	68
n.c.	Diamine fast orange	C			Germany	32
n.c.	Diamine fast orange EG	C				
n.c.	Diamine fast orange ER	C				
n.c.	Diasamine blue BR conc. 6-10	S	10,009		Switzerland	100
n.c.	Diazo blue NA	L	2,205		Germany	100
n.c.	Diazo sky blue B	By	1,008		Germany	100
	Oxamine fast blue		2,692	2,641	Germany	93
n.c.	Oxamine fast blue RR	B			Canada	7
n.c.	Oxamine fast blue 6B	B				
n.c.	Minazo fast blue RRX (50%) (Oxamine fast blue RRX)	B				
	Parasulphon brown		1,000	636	Switzerland	100
n.c.	Parasulphon brown G	S				
n.c.	Parasulphon brown V	S				
	Unidentified Sulphur Dyes					
	Thional yellow 2G	S	2,002		Switzerland	100
	Unidentified Basic Dyes					
	Rhodamine		1,652	7,043	Switzerland	100
n.c.	Rhodamine 4GD	I				
n.c.	Rhodamine 6GH conc. (425%)	I				
n.c.	Rhodamine 6GH (400%)	I				

Ernest C. Klipstein Dies

Ernest Christian Klipstein, head of E. C. Klipstein & Co., the Warner-Klipstein Co. and the Bulls Ferry Chemical Co., died Sunday morning, April 29. Mr. Klipstein had been stricken with an attack of kidney trouble only 4 days prior to his death and was taken to St. Vincent's Hospital, New York City, but failed to respond to treatment. He was born in Virginia in 1851 and for many years had occupied a prominent position in the dye and chemical industries of this country. He is survived by his wife and three sons, Ernest H., Gerald P. and Kenneth H. Mr. Klipstein had lived in East Orange, N. J., since 1889, and funeral services were held at his late home there on Tuesday afternoon, May 1.

Financial Notes

A large percentage of the securities of the St. Louis Coke & Chemical Co. has been pledged to the readjustment plan of the company's financial structure, which would reduce fixed charges from $1,230,248 to $454,160. The readjustment of the finances will undoubtedly be through the medium of a new company, says a report from St. Louis.

Mathieson Alkali Works, Inc., reports for the quarter ended March 31 last net earnings of $386,303 after depreciation, compared with $151,667 a year ago. Gross earnings totaled $521,227, against $286,750.

Stockholders of the Commercial Solvents Corporation at a special meeting authorized an issue of $1,000,000 8 per cent first preferred stock for the purpose of building a new plant.

Tennessee Copper & Chemical Corporation shows a net income of $337,421 for 1922, equivalent to 42c. a share earned on the 794,426 shares of capital stock of no par value. This compares with a net income of $147,175, or 18c. a share, in the previous year.

The New Jersey Zinc Co. reports income of $1,905,456 for the first 3 months of 1923. This includes dividends from subsidiary companies and is after deduction of expenses, taxes, maintenance, depreciation and other charges. The total compares with $1,126,080 in the same period in 1922.

The American Hide & Leather Co. reports a deficit of $118,175 for the first 3 months of 1923, after payment of all operating expenses, interest on loans, reserves for depreciation and other charges. This compares with a deficit of $23,221 in the same period last year.

The Columbia Textile Co. for the quarter ended March 31 reports net sales of $1,513,177 and net income available for bond interest, after depreciation and other charges, of $111,631.

Facts and Figures That Influence Trade in Chemical Products

Market Conditions

Current Prices
Imports and Exports
The Trend of Business

Irregular Price Movement Features Trading in Chemicals

Acetic Acid Advanced in Price—Bichromates Stronger—Formaldehyde Steadies—Tin Crystals Lower—Nitrite of Soda Weakens Under Increased Offerings—Red Prussiate of Potash Sells Off Sharply—Glaubers Salts Weak

THE movement of prices for chemicals in the past week has been very irregular. In some cases imported makes have come on our market in sufficient volume either to beat down the prices asked for domestic goods or to cause their own offering at buyers' prices. Nitrite of soda is one of the materials which came in from abroad only to find an unreceptive market and many holders preferred to cut prices rather than hold for a higher market later on. Glaubers salt was in a similar position, with little chance of a stronger market until supplies get into stronger hands. In a few cases such as bichloride of tin and tin crystals lower prices were the result of reduced production costs. On the other hand the advance in acetate of lime as announced a week ago had the effect of bringing out new price schedules for acetic acid, but as some producers were affected more than others by the change in the raw material it was natural to look for a difference in quotations for the acid and there is a range according to seller, especially on the higher grades.

Export buying, which has been a feature in the market for caustic soda so far this year, was less pronounced and values were a little less firm, as some sellers were willing to sacrifice a little in order to book business. On the other hand heavy arrivals of arsenic from foreign markets were readily absorbed on arrival here. The arsenic situation shows little if any change. Buyers have their ideas as to what they want to pay and when their limit has been reached they retire from the market. In spite of reports that an extensive short interest exists, this is not borne out in the market, which would be highly sensitive to heavy buying. Formaldehyde still feels the effects of second-hand offerings, but the latter have been much reduced in volume and the market is coming under the control of producers who say that resale lots recently have sold under the cost of production. Red prussiate of potash was practically a drug on the market a short time ago. Some holders of stocks began to sell at private terms and far enough under the quoted levels to interest buyers. In this way considerable of this material has changed hands, but there is no such thing as firmness in price.

Acids

Acetic Acid—The market has been in a rather unsettled position, following the recent advance in acetate of lime. Producers of acid who require acetate of lime have put up prices, but some difference is found according to seller. Several of the largest consumers are covered on old contracts, but business was reported to have been good during the past week. Prices for 28 per cent are given at 3.38c. per lb. and for 56 per cent 6.75c. per lb. These quotations are for carlots with the usual premiums for smaller lots. Glacial acetic acid is still available at 12c. per lb., carlots, although most sellers are asking higher prices.

Boric Acid—Some producers lowered asking prices during the period. Demand was moderate, but competition is rather keen. Present prices show a range from 11c. to 11½c. per lb., in barrels, for round lots, the difference being according to seller.

Hydrofluoric Acid — According to a report just issued by the Department of the Interior there were 4,800 short tons of fluorspar shipped to makers of hydrofluoric acid in 1922, as compared with 1,833 short tons in 1921. This would indicate a material increase in the output of the acid last year. The present market is a quiet affair. Asking prices are unchanged at 7@8c. per lb. for 30 per cent and 11@12c. per lb. for 48 per cent.

Sulphuric Acid—Inquiry for prompt delivery has eased off a little, but contract holders are calling for stocks and the position of producers has hardly improved. With some sellers prices are little better than nominal, but former prices are still holding, with 60 deg. acid quoted at $9.50@$11 in tanks and 66 deg. acid at $16@$16.50.

Tartaric Acid — With the buying movement holding up, the strength of the market was demonstrated by another advance of 1½c. per lb. last week. The revised asking price is 37½c. per lb. and the market was reported to be strong even at the advance. Imported tartaric sold earlier in the period at 36c. per lb. and an offering for shipment was made on the basis of 29c. per lb. in bond.

Potashes

Bichromate of Potash—Some delays in deliveries are reported and the market has taken on a stronger tone as far as prices for prompt shipment are concerned. The general asking price is given at 11c. per lb., f.o.b. works.

Caustic Potash—Sales of small lots of imported were made at 8¼c. per lb. on spot and some goods afloat sold at 8c. per lb. The general asking price for imported on spot was 8¼c. per lb. Some producers of domestic caustic put prices up to 9c. per lb. at works, but there were offerings of domestic make at 8¼c. per lb. and prices showed a range according to seller. Opinions differed regarding the strength of prices and regarding the outlook for the present.

Muriate of Potash—New prices on German muriate have been expected but so far have not been made. The market is unsettled, as offerings are widely scattered and selling pressure has weakened values. The current quotation of $35 per ton is still subject to shading.

Permanganate of Potash — While prices of 22c. to 24c. per lb. were asked for spot material there was not much trouble in finding sellers at the inside figure. Offerings afloat were available at 21½c. per lb. and prompt shipment was quoted at 21c. per lb. Demand was not large and this no doubt influenced some holders to offer inducements in order to dispose of stocks that they have on hand.

Prussiate of Potash — Red prussiate has been quietly selling at private terms for the past 2 weeks or more. Last week prices were lower than ever, and sales went through as low as 70c.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	179.28
Last week	179.23
May, 1918	270.00
May, 1919	248.00
May, 1920 (high)	280.00
May, 1921 (low)	143.00
May, 1922	159.00

The index number for the week shows a moderate gain. The advances in acetic acid, formaldehyde in outside selling channels, and caustic potash, brought about the 5 point rise.

per lb. The market closed unsettled, with intimations that 70c. could still be done by buyers. Yellow prussiate was in quiet demand and while 37c. per lb. is asked, this price likewise can be shaded.

Sodas

Bichromate of Soda—The market is stronger with reports that the output of some producers has been curtailed. Sellers have been less eager for round lot orders, especially for prompt shipment. The asking price is generally held at 8c. per lb., with spot offerings having changed hands in a small way at 7¾c. per lb.

Caustic Soda—While export orders still are heard and some of good volume, it is evident that the demand from overseas has fallen off as standard makes have been offered at 3.40c. and other brands were free at 3.30c. for New York. Domestic buyers are taking deliveries with regularity, but total business for the week appeared to be on the decline. Prices for standard makes continue at 2¼c. per lb., carlots, at the works, basis 60 per cent, and upward for smaller lots.

Fluoride of Soda—Increased production costs have been a factor in the market for domestic made fluoride and asking prices have responded. The quotation for round lots is now 11c. per lb. works. Offerings of imported also are firmer and 9¼@9¾c. per lb. is asked.

Nitrate of Soda—Demand from the fertilizer trade has been of small proportions and prices for 95 per cent are easy as a result. There were offerings at $2.50 per 100 lb. f.o.b. Charleston, during the week, but spot material at New York was limited and was pretty well held at $2.60 per 100 lb. There were no new developments as far as shipments were concerned and new contract prices have not yet been named.

Nitrite of Soda—Imported material has been reaching the market in a rather large way. In fact the pressure of such offerings has had a depressing effect on prices and offerings were freely available on spot at 8c. per lb. For shipment 7¾c. per lb. could be done and with lower cables from primary points abroad the situation showed a decided change in buyers' favor.

Prussiate of Soda—The market for yellow prussiate of soda has settled at the 17½c. per lb. level. This price is quoted by first hands and any material held by others must meet this competition. Imported was largely neglected, with shipment prices reported fractionally higher than the price asked for domestic.

Miscellaneous

Acetate of Lime—The new price list was in effect throughout the week and sellers agree that price shading will not be a factor unless there is a change in fundamental conditions which will admit of manufacture at a larger margin of profit. Current prices are 4@4.05c. per lb.

Acetone—For spot goods the price is 25c. per lb. and upward on a quantity basis. On round lot shipments from works the quotation is 24½c. per lb. The recent marking up in price brought about increased inquiry, but actual orders placed are said to be moderate.

Arsenic—There were reports of sales of white arsenic in the spot market at 15¼@15⅝c. per lb. Interest is keen but reports differ on the volume of business placed. Rather heavy arrivals from abroad were reported but most of these seemed to be destined to fill old orders. From the various reports heard it is clear that no decided price movement threatens. This is shown by offerings of immediate from Canada at 15c. per lb., with the same price quoted for May-June shipment. Until buying becomes more active it would seem that offerings are large enough to prevent any sharp advances in price.

Bleaching Powder — Recent slowing up in consuming demand has brought out some selling pressure. Producers who found goods accumulating began to cut values in order to attract new accounts and this has been done by so many factors that it is almost equivalent to a general lowering of prices on prompt shipment from 2c. to 1.90c. per lb. for large drums, f.o.b. producing point. The contract price is unchanged at 1.90c. per lb. works.

Copperas — Producers report fairly active trading and a firm situation, business passing at $29@$29.75 per ton, f.o.b. works.

Copper Sulphate — There was no change in the position of imported sulphate and prices continue to be easy. On spot goods said to be of good quality are offered at 5¼c. per lb., with the possibility of buying under that level on a firm bid. The same price applies to shipments. Domestic sulphate is affected somewhat by the competition from foreign, but some producers have a good part of their output sold ahead and are relying on quality to uphold demand for their goods even at a price differential. Prices for domestic are quoted at 6c. to 6.50c. per lb. according to seller and quantity.

Formaldehyde—Odd lots still appear on the market. Sales at 14¾c. per lb. were noted and it is believed that more lots at that figure can be located. In general, however, the market is working into a firmer position as 15c. per lb. is the lowest price of prominent factors and 15½c. per lb. is quoted by many. It is a question of cleaning up the second-hand lots before the market will settle at the higher level.

Methyl-Acetone — Makers announced an advance of 5c. per gallon, following closely upon the uplift in the market for acetate of lime. The revised schedule of prices quotes 80c. per gal. in tank cars and 85c. per gal. in drums, round-lot basis.

Tin Crystals—Lower price levels have been announced for May deliveries. The easier position of the metal market is responsible for the reduction in crystals. Current prices are 35½@36c. per lb., or a decline of 1½c. per lb. from the April figures. Bichloride of tin also was marked down and is offered at 12½@13c. per lb.

Denatured Alcohol Steadies

Some traders reported a better feeling in the market for denatured alcohol as outside offerings were not so much in evidence. The demand was fair and holdings were not considered large. On the No. 1 special the market held at 33c per gal. in drums, and 39c. per gal. in barrels, round-lot basis. The No. 1, 188 proof, completely denatured, was maintained at 41c. per gal., in drums. Ethyl spirits, U.S.P., 190 proof, closed unchanged at $4.70 per gal., in barrels. Producers of methanol reported the market as firm, but quotably unchanged at $1.18 per gal. for the 95 per cent, and $1.20 per gal. for the 97 per cent. The fact that other wood distillates were advanced about a week ago apparently had no influence on methanol.

Philip Weisenthal Arrested On Charges of Fraud

Philip Weisenthal, president of a chemical firm in Hamburg, Germany, and with New York offices at 565 Broadway, was arrested on Monday as he reached New York on the steamer "American Legion." Mr. Weisenthal is charged with defrauding the American Express Co. of $300,000, secured as loans against fraudulent invoices. Sidney Hass, manager of the New York branch of the Weisenthal interests, also was taken into custody. Both men are charged with grand larceny and forgery.

It is stated that Weisenthal, after getting export invoices passed by the American consular agent at Hamburg, made out new invoices in which the value of the goods was increased materially over the amounts shown on the original invoices. The false invoices were then presented to the Hamburg agent of the American Express Co. and loans negotiated on the basis of the raised figures. Weisenthal led his pursuers a lengthy chase before being taken into custody. He left Germany for London and from the latter city sailed to Las Palmas, thence to Rio de Janeiro, to Buenos Aires, and from the latter port to New York.

Cobalt and Cellulose Imports Included in Return

Beginning on May 1, the Chemical Division of the Department of Commerce expanded its service of recording chemical imports through the port of New York by adding those chemicals covered by paragraphs 27 and 28 of the tariff law. Paragraph 27 refers to cobalt oxide and other cobalt salts and compounds. Paragraph 28 refers to compounds of pyroxylin and other cellulose esters.

Coal-Tar Products

Spot Phenol Steady—Consumers Not So Anxious Over Future Supply —Benzyl Chloride Higher—Creosote Oil Arrives From Hull

THE output of the byproduct coke ovens has increased steadily since the first of the year, yet the supply of coal-tar bases has not shown a corresponding gain. This is explained by the fact that producers and distillers have found it more profitable to utilize this material in crude form for heating purposes, manufacturing roofing materials, road-binders, etc. As a result the output of natural phenol is not likely to increase appreciably, and with sufficient tariff protection the trade is now looking forward to a larger output of the synthetic product. Phenol on spot sold in a small way during the past week at prices ranging from 55@57c. per lb., but on contract there was a possibility of doing business at close to 28c.

The drop in gasoline naturally led traders to look for an easier situation in benzol, but producers announced no change in their policy of marketing this commodity. The production is moving in a satisfactory way in motor fuel channels and so far as the pure grade is concerned prices are firmly maintained. The arrival of a cargo of creosote oil from Hull attracted much attention. The demand for creosote oils has been good and firm prices were the rule. Producers of benzyl chloride advanced contract prices. Benzaldehyde, technical, was in good demand. Naphthalene on spot was nominally unchanged. Cresylic acid was offered more freely by producers, and this was reflected in easier prices for the imported material for either immediate or nearby delivery. There were no new developments in connection with the tariff on cresylic acid. Xylenes were in scanty supply and so far as spot material was concerned the market was in a wholly nominal position.

Benzene—The production appears to be well taken care of despite numerous reports of a quiet state of trade. The decline in prices for gasoline did not change the attitude of producers, who seem to feel that consumption of motor benzol will not meet with any serious setback. Production of the pure benzol is moderate and prices ruled steady in nearly all directions. The 90 per cent benzol held at 27c., contract basis. The pure was unchanged at 30@32c. per gal., in drums, carload lots or more.

Creosote Oils—A round lot of creosote oil arrived at New York last week from Hull. The market was fairly active and with domestic production well taken care of prices were firmly maintained. On the 25 per cent grade the market settled at 34@36c. per gal.

Cresylic Acid — New production is coming in, and this influenced holders of foreign material to offer supplies a little more freely. Nominal quotations on the 97 per cent grade, in drums, ranged from $1.25@$1.30 per gal.

Naphthalene — New contract prices were not announced, but a feeling prevails that the range will be higher than last year, when the bulk of the output of domestic producers sold at 6½@7c. per lb. The spot market for ball and flake was nominal at 9½@10c. per lb. Demand was not up to expectations.

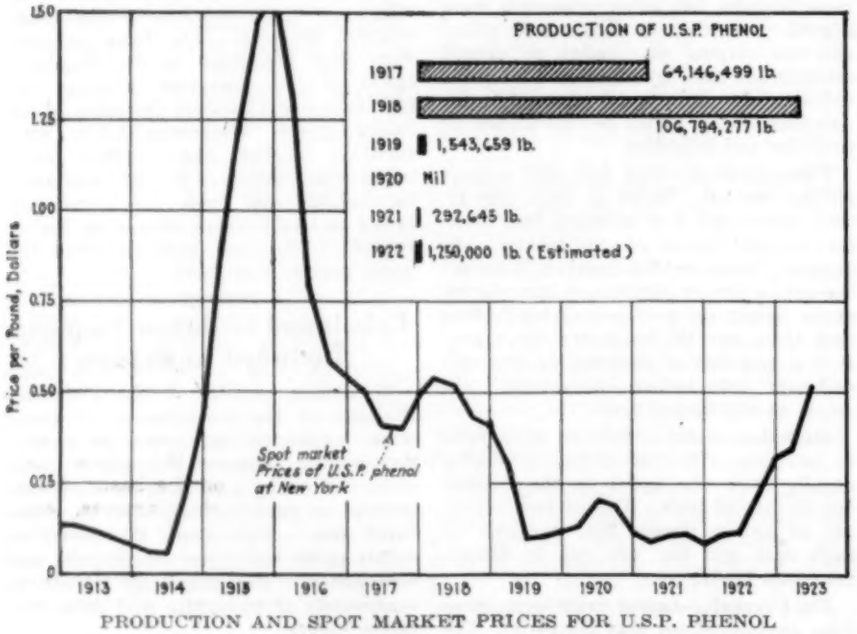
Phenol—Scattered lots of spot material sold through second-hands at 55 @57c. per lb. The traders were not so bullish on forward material, feeling that enough new production of the synthetic phenol would come on the market in the near future to take care of the expansion in business. On contract material producers were not openly quoting, but it was reported that last sales went through around 28c. Producers were not at all pleased with the efforts of speculative traders to "bull" the market.

Benzyl Chloride — Production will soon be increased so as to meet the requirements of the trade, but prices will be raised because of the higher cost of manufacture. The leading producer will revise his schedule on the 95@97 per cent refined to 45c. per lb. and on the technical to 30c. per lb., deliveries to commence in July.

Benzaldehyde—There was a good call for the technical grade at 75c. per lb. in drums and 80c. in cans. The market closed firmer.

Salicylic Acid—Demand was quiet all last week, but with stocks moderate prices were steady at 47@48c. for the technical.

Xylene—The pure in drums, on spot, sold through outside channels at 95c.@ $1 per lb. The contract price was unchanged at 75c. per lb.



PRODUCTION AND SPOT MARKET PRICES FOR U.S.P. PHENOL

Trade Notes

The Naphthalene Products Co. is a new concern at Birmingham, Ala., which has begun to manufacture refined naphthalene products.

The purchase by Certainteed Products Corporation of the properties of Cook's Linoleum Co. and the Standard Inlay Co. has been ratified by the stockholders of all of the corporations and titles have been passed.

John D. Ryan, chairman of board of directors of the Anaconda Copper Mining Co., in commenting on the income statement of the company, stated that the zinc oxide plant at East Chicago operated throughout the year and produced 2,008,535 lb. Construction of an operating unit of a French process plant with capacity of approximately 16,000 lb. of zinc oxide daily was about completed, while a similar plant was in process of construction at Akron, Ohio.

The Air Reduction Co. has leased offices in the Canadian Pacific Building, Madison Ave. and 44th St.

The United Smelting & Aluminum Co., Inc., of New Haven, Conn., has opened a new warehouse at 216-218 Water St., New York City, to which it is also removing its offices.

The annual meeting and election of officers of the Paint, Oil and Varnish Club of New York will be held on Thursday, May 10, at Delmonico's. Senator Royal S. Copeland will be the guest of honor.

The plant of the Cornwall Chemical Corporation, at Cornwall, below Newburgh, was destroyed by fire May 1, with an estimated loss of $100,000. The fire started when chemicals, leaking from a storage tank, came in contact with boilers and exploded.

Vegetable Oils and Fats

Linseed Oil Futures Lower—Nearby Cottonseed Oil Steady—China Wood Easier—Coconut Unsettled—Tallow Declines

TRADING in vegetable oils and animal fats was quiet all week and the tendency of prices, taken as a whole, was toward lower levels. Liquidation in imported linseed oil resulted in a very unsettled market for the foreign material. Domestic linseed oil for summer delivery went off fully 5c. per gal. Shorts were buyers of May cottonseed oil in the option ring and this served to steady prices for the old crop months. Crude was nominally unchanged. China wood oil was offered more freely for shipments. Easier prices obtained for coconut, soya, palm and sesame oils. Tallow again went off, outside goods equal to extra bringing 8¼c. per lb. delivered. There was little or no buying interest in fish oils for future delivery.

Linseed Oil—Crushers continued to offer spot oil in a rather limited way and prices held on the $1.17 per gal. basis for carload lots, cooperage included. On futures, however, the situation eased off until several crushers appeared anxious for July forward business at $1.05 per gal., carload lots, cooperage basis. Demand was quiet all week and the larger consumers could not be interested in forward material. The fact that close to 5,000,000 bushels of seed are now afloat consigned to United States ports led many to take the stand that the oil situation will soon right itself. Argentine shipments continue at a liberal rate and last week saw several offerings of Indian seed at a premium of only 15c. per bushel over the prevailing c.i.f. quotation on the Argentine product. A small parcel of Moroccan seed also was available. With indications of a larger acreage in the northwest the seed supply in sight for the remainder of the year looms up rather large, notwithstanding the healthy increase in the volume of oil sales. Domestic cake prices were steady so far as crushers were concerned, the market settling around $36.50 per ton, f.a.s. New York. Imported oil was unsettled all week. Receipts were larger and this prompted some "profit taking" by the speculative element. Spot foreign oil sold down to $1.05 per gallon, in barrels, Private advices from London reported sales of bulk oil for June-July shipment to America. May shipment from the other side closed nominally at $1.05 per gal., in barrels, duty paid.

Cottonseed Oil—May oil in the option market on the Produce Exchange was steady to firm on covering by shorts. Futures were unsettled on the general weakness in other commodities. The sugar investigation put a damper on speculative activity. New crop developments attracted attention and several private preliminary estimates on acreage indicated an increase in the plantings of approximately 10 per cent. May oil, prime summer yellow, sold up to 11.83c. during the week. December sold under 9c. per lb. Crude held at 10c. mills on actual sales. Rumors that this figure could be shaded lacked confirmation. Bleachable oil was offered at 11¼c., buyers' tanks, f.o.b. New York, with no buyers. Cash trade in cooking oil and lard compound was slow, yet no weakness developed in the local market. Operators now believe that the April consumption figures when available may show that not more than 150,000 barrels were disposed of. Lard stocks in Chicago increased 21,000,000 pounds during the month of April. Lard compound was nominally unchanged at 13¼c. asked, carload lots, f.o.b. New York. Oleo stearine was easy at 10½c., with no sales.

China Wood Oil—The undertone was easier on free offerings from the coast. Spot oil settled at 35@38c. per lb., while on futures there were sellers at 26@27c. per lb., f.o.b. New York, according to position. Trading was dull.

Coconut Oil—The coast market for Ceylon type oil was unsettled with sales of several tank cars of May at 8⅜c. Most traders, however, continued to ask 9c. on coast business. Ceylon type oil was offered in the New York trade at 9¼c. per lb., sellers' tank cars, immediate shipment. Copra was quiet but unchanged at 5⅝@5¾c. per lb., c.i.f. coast, standard brands. Copra cake was offered at $31@$32 per ton, f.a.s. New York.

Corn Oil—The market held at 10⅜c. per lb. tank cars, f.o.b. point of production, or 10½c. Chicago.

Olive Oil Foots—There were offerings of Greek prime green foots for immediate shipment from the other side at 9½c. per lb. landed weights, ex-dock New York.

Palm Oils—Lagos oil sold to tin-plate mills at 8⅜c. per lb. nearby delivery. Niger oil sold on spot at 7⅞c. per lb., while on futures there were offerings at 7⅞c. per lb.

Soya Bean Oil—Bulk oil for shipment from the Orient was worked at 7.75c. per lb. in bond, c.i.f. New York. The coast market on nearby crude settled at 10⅜@10½c. per lb. sellers' tanks, duty paid, a decline of ⅛c. for the week. Demand was less active because of the unsettled market for linseed oil for future delivery.

Fish Oils—There were offerings of crude menhaden oil for future delivery, "if made," at 50c. per gal. in tanks, f.o.b. fish factory. No sales were reported. Newfoundland tanked cod oil closed at 70c. per gal., in barrels, f.o.b. New York.

Tallow and Greases—The last sale of extra special tallow went through at 8½c. per lb., f.o.b. plant, a decline of ⅛c. Outside goods, equal to extra in quality sold at 8¼c. per lb. delivered. The market was easy at the close. At the London auction, held May 2, 1,716 casks were offered and 424 were disposed of. Prices realized were unchanged to 1 shilling lower. Yellow grease in the New York trade closed at 8c. nominal.

Miscellaneous Materials

Glycerine—The feature in the market was the firmer position of crude glycerine, several cars selling at 10½@11c. per lb., on the soap-lye, basis 80 per cent, the top figure prevailing towards the close. There were bids at 11c. on Friday. Saponification was more or less nominal at 12½@12⅝c., loose, basis 88 per cent. There were no transactions in saponification. Dynamite was offered at 16⅜c., in drums, carload lots, f.o.b. New York territory, with last sales at 16⅛c. Chemically pure was unsettled in some directions and a little business was placed at 17⅜c. per lb., in drums. Refiners generally held out for 18c. per lb.

Shellac—The market was quiet and irregular, closing prices being slightly lower than a week ago. T. N. was offered at 69c. on spot. Bleached, bone-dry, held at 82@84c. per lb., nearby delivery. Superfine orange was available at 74@76c. per lb. Cables from Calcutta were easier and speculators were disposed to favor the bear side for the time being. Demand was routine only so far as the consuming trades were concerned.

Naval Stores—A sharp drop in spirits of turpentine occurred last week, amounting to 12c. per gal. The demand fell away because of the recent showing of weakness and with new crop offerings on the increase the market favored buyers. At the close the nominal quotation stood at $1.30 per gal. Rosins also were easier, but no important price movement took place. Rosin oils closed unchanged.

Lithopone—Demand was seasonally active and with no change in basic materials, prices held at 7@7¼c. per lb. carlots, the inside obtaining for bags.

White Lead—Another drop in the price of the metal failed to bring out a change in the market for lead pigments. Pig lead closed at 7⅜c. per lb., which compares with 8c. a week ago. Demand for white lead was fairly active. Corroders have sent a notice to the trade offering lead pigments for shipment through to August on a guarantee against decline basis. Standard dry white lead, basic carbonate, held at 9⅜c. per lb. in casks, carload lots or more.

Zinc Oxide—Spelter was easier, but not so as to influence the market for oxide. Prices held on the basis of 8c. per lb. for the American process, lead free, carload lots. The French process, red seal, was unchanged at 9⅜c. per lb. Several plants are under construction to produce Franch process oxide, according to reports.

Imports at the Port of New York

April 27 to May 3

ACIDS—12 dr. cresylic, Manchester, Order; 85 dr. cresylic, London, Celluloid Co.; 100 bg. stearic, Hamburg, Innis, Speiden & Co.; 60 dr. cresylic, Glasgow, Order.

ALCOHOL — 51 csk. butyl, Bordeaux, Order.

ALIZARINE — 12 csk., Liverpool, A. Klipstein & Co.

AMMONIUM—22 cs. phosphate, Hamburg, Bengol Trading Co.; 42 csk. muriate, Liverpool, Brown Bros. & Co.; 10 cs. carbonate, Liverpool, Brown Bros. & Co.

ANTIMONY SULPHIDE—14 csk., F. B. Vandegrift & Co.

ARSENIC — 28 csk., Bordeaux, N. Y. Trust Co.; 144 dr., Durban, C. Tennant Sons & Co.; 100 bbl., Tampico, American Metal Co.; 100 cs., Rotterdam, Lunham & Moore; 215 csk., Marseilles, Order.

ASBESTOS—1,300 bg., Cape Town, Irving Bank-Col. Trust Co.; 626 bg., Durban, D. D. Crumpton.

BARIUM CHLORIDE—212 pkg., Hamburg, Roessler & Hasslacher Chem. Co.; 24 bbl., Hamburg, Innis, Speiden & Co.; 28 bbl., Hamburg, Order; 14 csk., Hamburg, Order; 42 csk., Hamburg, Innis, Speiden & Co.; 26 csk., Hamburg, E. Suter & Co.

BARYTES—399 bg., Bremen, N. Y. Trust Co.

BLANC FIXE — 68 bbl., Hamburg, A. Murphy & Co.; 4 csk., Hull, Meteor Products Co.

BRONZE COLOR—44 cs., Bremen, Baer Bros.

CASEIN — 10 bg., Hamburg, Hensel, Bruckman & Lorbacher; 266 sk., Bordeaux, J. A. W. Bird; 50 sk., Bordeau, Monito Waterproof Glue Co.; 584 bg., Buenos Aires, T. M. Duche & Sons; 1,393 bg., Buenos Aires, Brown Bros. & Co.; 1,842 bg., Buenos Aires, Kalbfleisch Corp.; 274 bg., Buenos Aires, Brown Bros. & Co.; 700 bg., London, Brown Bros. & Co.

CALCIUM CHLORIDE—317 dr., Hamburg, Blackburn Trading Co.; 323 dr., Hamburg, H. J. Baker & Bro.

CAMPHOR—280 cs., Hamburg, A. Ochse & Co.

COAL-TAR DISTILLATE—38 dr., Liverpool, Order.

CHEMICALS—80 bbl., Hamburg, Roessler & Hasslacher Chem. Co.; 25 pkg., Hamburg, Jungmann & Co.; 112 pkg., Hamburg, Order; 74 cs., Bremen, Pfaltz & Bauer; 426 csk., Rotterdam, Hummel & Robinson; 20 bbl., Hamburg, Hummel & Robinson; 27 csk., Hamburg, Jungmann & Co.; 100 pkg., Gothenburg, Powers, Weightman & Rosengarten.

CHALK — 1,150 bg., Antwerp, Bankers Trust Co.; 508,000 kilos, Dunkirk, J. W. Higman & Co.; 1,666,317 kilos, Dunkirk, Tainter Trading Co.; 500 tons, London, Baring Bros. & Co.; 1,000 tons, London, Tainter Trading Co.

COLORS—55 cs. bronze, Hamburg, Bank of the Manhattan Co.; 2 bbl. aniline, Hamburg, Fezandie & Sperrie; 21 csk. do., Hamburg, H. A. Metz & Co.; 21 csk. do., Hamburg, Bank of the Manhattan Co.; 21 csk. do., Hamburg, G. A. Kuhl; 37 csk. do., Hamburg, Guaranty Trust Co.; 4 csk. do., Hamburg, N. Y. Color & Chemical Co.; 7 csk. do., Hamburg, Carbic Color & Chemical Co.; 45 csk. do., Hamburg, Grasselli Chemical Co.; 50 csk. do., Hamburg, Kuttroff, Pickardt & Co.; 7 csk. do., Hamburg, Guaranty Trust Co.; 4 cs. do., Hamburg, J. C. Robold & Co.; 12 csk. aniline, Hamburg, H. R. Jahn; 10 csk. do., Hamburg, Franklin Imp. & Export Co.; 4 dr. aniline, Southampton, Order; 20 csk. dry, Southampton, Order; 11 csk. aniline, Hamburg, Kuttroff, Pickardt & Co.; 56 csk. aniline, Hamburg, E. C. Foster; 42 pkg. do., Antwerp, Geigy Co.; 100 csk. venetian red, Liverpool, J. L. Smith & Co.; 190 pkg. dry colors, Hull, J. L. Smith & Co.; 4 csk. vermilion, London, C. H. Powell & Co.; 17 cs. aniline, Havre, Sandoz Chem. Works; 8 csk. do., Havre, Irving Bank; 10 bbl. aniline, Genoa, Nat'l Aniline & Chem. Co.; 24 bbl. do., Genoa, Order.

COPPER SULPHATE—107 bbl., Hamburg, Order; 94 csk., London, Ore & Chem. Corp.; 100 csk., Liverpool, Westminster Bank; 129 bbl., Hamburg, Order.

COPRA—75 bg., Port Antonio, Order.

CREOSOTE—100 csk., Manchester, T. D. Downing & Co.; Round-lot of oil in bulk, Hull, Order.

DEGRAS—162 bbl., Hull, Order.

DIVI-DIVI — 983 bg., Maracaibo, Am. Trading Co.; 1,781 bg., Maracaibo, Paris & Co.; 1,652 bg., Monte Cristi, V. Y. & Hanseatic Co.

EPSOM SALT—48 bg., Bremen, A. Blank; 500 bg., Bremen, Globe Shipping Co.; 835 bg., Hamburg, Innis, Speiden & Co.; 218 csk., Hamburg, Roessler & Hasslacher Chem. Co.

FUSEL OIL—8 dr., Dunkirk, Guaranty Trust Co.; 11 dr., Dunkirk, Order.

GLYCERINE—20 csk., Bordeaux, Order; 25 csk., Marseilles, Brown Bros. & Co.; 60 csk., Marseilles, Order.

FUSTIC—460 pc., San Juan de Sur, W. R. Grace & Co.

GUMS—60 bg. damar, London, S. Winterbourne & Co.; 305 bg. copal, Antwerp, Central Union Trust Co.; 345 bg. do., Antwerp, Chemical Nat'l Bank; 102 bg. copal, Antwerp, Order; 35 bg. copal and 70 cs. damar, Singapore, France, Campbell & Darling; 385 bg. copal, Singapore, Order; 200 cs. damar, Batavia, Chem. Nat'l Bank; 200 cs. damar, Batavia, Nat'l City Bank; 181 sk. copal, Matadi, L. C. Gillespie & Sons; 230 cs. damar, London, France, Campbell & Darling; 1,604 bg. copal, Matadi, L. C. Gillespie & Sons; 579 bg. copal, Matadi, Niger Co.; 100 cs. damar, Singapore, Baring Bros. & Co.; 420 pkg. arabic, Sudan, Thurston & Braidich; 1,210 pkg. arabic, Sudan, Order; 114 bg. copal, London, Order.

GAMBIER—501 cs., Singapore, N. Y. Trust Co.; 504 cs., Singapore, Order; 85 cs., London, Order.

IRON OXIDE—28 bbl., Malaga, C. F. Olson & Co.; 100 bbl., Malaga, E. M. & F. Waldo; 38 bbl., Malaga, L. H. Butcher & Co.; 125 bbl., Malaga, Reichard-Coulston, Inc.; 10 csk., Liverpool, C. B. Crystal & Co., 72 csk., Liverpool, Reichard-Coulston, Inc.; 34 csk., Liverpool, J. Lee Smith & Co.

LYCOPODIUM—179 pkg., London, Order.

MAGNESITE — 88 csk., Rotterdam, Speiden-Whitefield Co.

MAGNESIUM — 20 csk. sulphate, Manchester, Order; 50 cs. calcined, Newcastle, Order; 250 dr. chloride, Hamburg, Innis, Speiden & Co.; 61 dr. chloride, Hamburg, A. Kramer & Co.

MANGROVE—1,600 bg., Beira, Cooper & Cooper.

MYRBANE—12 dr., Manchester, Rendrock Powder Co.

NAPHTHALENE—269 bg., Manchester, Order; 1 cs., London, J. C. Robold & Co.

OILS—Castor—150 bbl., Hull, Order. **Cod**—300 bbl., Aberdeen, Order. **China Wood**—223 bbl., London, Order; 30 bbl., London, S. Winterbourne & Co.; 584 csk., Hankow, Equitable Eastern Banking Co. **Linseed** — 177 bbl., Rotterdam, Welch, Holme & Clarke Co.; 143 bbl., Rotterdam, Meteor Products Co.; 141 bbl., Rotterdam, Bur-Mac Chem. Corp.; 128 dr., Rotterdam, W. Van Doorn; 665 bbl., Rotterdam, Order; 200 bbl., Hull, Order; 444 bbl., London, Irving Bank-Col. Trust Co.; 438 bbl., London, Nat'l City Bank; 295 bbl., London, Order. **Olive Foots** (sulphur oil)—699,830 kilos in bulk, Bari, Order; 350 bbl., Naples, Banco Commercial Ital.; 200 bbl., Naples, Banca Comm. Italo. **Palm** — 264 csk., Liverpool, Niger Co.; 1,017 csk., Matadi, Niger Co.; 1,635 csk., Matadi, Niger Co.; 33 csk., Grand Bassam, Oelrichs & Co.; 171 csk., Liverpool, Fourth Nat'l Bank; 174 csk., Liverpool, D. Bacon; 70 csk., Liverpool, Niger Co.; 25 csk., Liverpool, Thornett & Fehr; 138 csk., Liverpool, Nat'l Bank of Commerce; 5 csk., Liverpool, Order. **Rapeseed**—500 bbl., Hull, Vacuum Oil Co.; 600 dr., Liverpool, Vacuum Oil Co.; 188 bbl., Liverpool, Busk & Daniels.

PHOSPHATE—200 bg. bone, Antwerp, Hollingshurst & Co.; 1,250 bg. bone, Antwerp, Order.

POTASSIUM SALTS—46 bbl. carbonate, Hamburg, Hans Hinrichs Chem. Corp.; 20 bbl. prussiate, Hamburg, Broedermann & Litzrodt; 237 bbl. nitrate, Brown Bros. & Co.; 240 dr., permanganate, Hamburg, Meteor Products Co.; 28 dr. permanganate, Hamburg, Bengol Trading Co.; 100 dr. permanganate, London, Order; 135 csk. salts, Hamburg, Roessler & Hasslacher Chem. Co.; 1,500 bbl. chlorate, Hamburg, Columbia Trust Co.; 75 dr. caustic, Hamburg, Peters, White & Co.; 1,000 csk. chlorate, Hamburg, Columbia Trust Co.; 700 csk. do., Hamburg Mech. & Metals Nat'l Bank; 13 csk. chlorate, 79 dr. caustic, 68 csk. alum, Hamburg, Order; 13 csk. carbonate, Bremen, P. H. Petry & Co.; 17 csk. permanganate, Rotterdam, Order; 1,000 bg. sulphate, Bremen, A. Vogel; 19 dr. permanganate, Hamburg, Bengol Trading Co.; 20 dr. permanganate, Hamburg, S. Rosenblatt; 65 csk. salts, Hamburg, E. Suter & Co.; 208 dr. salts, Hamburg, Superfos Co.; 125 dr. caustic, Hamburg, E. Suter & Co.; 65 csk. carbonate, Hamburg, Goldschmidt Corp.; 4,000 bg. muriate, Hamburg, Order; 1 lot manure salts, Hamburg, Order.

QUEBRACHO—21,211 bg., Buenos Aires, Order.

SEEDS—Linseed—47,834 bg. and 1,165,212 kilos in bulk, Buenos Aires, Order; 69,672 bg, Rosario, Order; 34,190 bg., Buenos Aires, Order; 43,349 bg., Rosario, Spencer Kellogg & Sons; 24,330 bg., Buenos Aires, Spencer Kellogg & Sons.

SAL AMMONIAC — 75 bbl., Hamburg, Hans Hinrichs Chem. Corp.; 29 bbl., Hamburg, Roessler & Hasslacher Chem. Co.; 28 csk., Hamburg, Order.

SHELLAC—700 pkg., London, Order; 15 bg. garnet, Hamburg, Kasebier-Chatfield Shellac Co.; 30 cs. garnet, Hamburg, Order; 17 bg. garnet, Hamburg, Irving Bank-Col. Trust Co.; 4 cs., Hamburg, Broedermann & Litzrodt; 18 bg. garnet, Hamburg, Order.

STARCH—1,000 bg. potato, Rotterdam, Stein-Hall & Co.; 500 bg. do., Rotterdam, Spier, Simmons & Co.; 250 bg. do., Rotterdam, Order.

SODIUM SALTS—113 dr. salts, Hamburg, C. S. Grant & Co.; 360 pkg. salts, Hamburg, Roessler & Hasslacher Chem. Co.; 300 bbl. chlorate, Hamburg, Monmouth Chemical Co.; 300 csk. hyposulphite, Hamburg, Order; 50 bg. silicate, Hamburg, Order; 500 csk. nitrite, Hamburg, Kuttroff, Pickhardt & Co.; 1,580 cs. cyanide, Hamburg, Roessler & Hasslacher Chem. Co.; 200 csk. hyposulphite, Hamburg, Order; 50 csk. perborate, Hamburg, Order; 160 csk. nitrate, Brevik, Norwegian Nitrogen Products Co.; 175 csk. nitrite, Hamburg, E. Suter & Co.; 250 bg. sulphate, Hamburg, A. J. Marcus, Inc.; 42 csk. bisulphite, Hamburg, Order; 48 csk. nitrite, Bergen, Order; 100 csk. hyposulphite, Marseilles, E. Walters; 125 csk. do., Marseilles, Nat'l City Bank.

SUMAC—350 bg., Palermo, Order.

TALC—200 bg., Bordeaux, E. M. & F. Waldo; 150 bg., Bordeaux, Reichard-Coulston, Inc.; 400 bg., Bordeaux, L. A. Salomon & Co.; 400 bg., Genoa, Order.

TARTAR—46 csk. crude, Naples, Tartar Chemical Works; 110 sk., Marseilles, C. Pfizer & Co.; 83 sk., Marseilles, Tartar Chem. Works; 140 sk., Lisbon, Tartar Chem. Co.; 100 sk., Bilboa, Tartar Chem. Co.

TALLOW—445 csk. beef, Buenos Aires, Order.

WAXES—387 bg. ozokerite, Hamburg, J. Dick; 52 bg. carnauba, Cara, London & Braz. Bank; 111 bg. carnauba, Cara, Order; 47 bg. bees, Cardenas, D. Steengrafe; 12 bg. bees, Santo Domingo, J. J. Julia; 8 bg. bees, Santo Domingo, F. Ricart & Co.; 63 bg. bees, Rio de Janeiro, Order; 50 cs. bees, Hamburg, Hummel & Robinson; 48 cs. bees, Havana, Order.

WHITING — 330 bg., Dunkirk, Tainter Trading Co.

ZINC CHLORIDE—37 csk., Hamburg, Order.

ZINC OXIDE — 25 bbl., Antwerp, Reichard-Coulston, Inc.; 22 bbl., Hamburg, A. Kramer & Co.; 400 bbl., Marseilles, Bankers Trust Co.

ZINC WHITE — 50 bbl., Marseilles, Reichard-Coulston, Inc.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	$0.38 –	....
Acetone, drums	lb.	.25 –	.25½
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.50
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.50
Boric, bbl.	lb.	.11 –	.11½
Citric, kegs	lb.	.49 –	.50
Formic, 85%	lb.	.14½–	.17
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.12 –	.12½
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks, 100 lb.		1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.06 –	.06½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.13½–	.13¾
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.50 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	16.00 –	16.50
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp. crys., bbl.	lb.	.36½–	....
Tartaric, imp., powd., bbl.	lb.	.36½–	....
Tartaric, domestic, bbl.	lb.	.37½–	....
Tungstic, per lb.	lb.	1.10 –	1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.75 –	4.95
Ethyl, 190 p'f, U.S.P., bbl.	gal.	4.70 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof No. 1, special bbl.	gal.	.39 –	.41
No. 1, special, dr.	gal.	.33 –	.35
No. 1, 188 proof, bbl.	gal.	.40 –	.42
No. 1, 188 proof, dr.	gal.	.34 –	.36
No. 5, 188 proof, bbl.	gal.	.38 –	.40
No. 5, 188 proof, dr.	gal.	.32 –	.34
Alum, ammonia, lump, bbl.	lb.	.03¼–	.03¾
Potash, lump, bbl.	lb.	.03 –	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.05¾
Aluminum sulphate, com. bags	100 lb.	1.50 –	1.65
Iron free bags	lb.	.02½–	.02½
Aqua ammonia, 26°, drums	lb.	.06½–	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. casks, imported	lb.	.09½–	.10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 –	.14
Ammonium nitrate, tech., casks	lb.	.10 –	.11
Amyl acetate tech., drums	gal.	3.50 –	3.75
Arsenic, white, powd., bbl.	lb.	.15 –	.15½
Arsenic, red, powd., kegs	lb.	.14½–	.15
Barium carbonate, bbl.	ton	78.00 –	80.00
Barium chloride, bbl.	ton	90 00 –	95.00
Barium dioxide, drums	lb.	.18 –	.18½
Barium nitrate, casks	....	.08 –	.08½
Barium sulphate, bbl.	lb.	.04 –	.04½
Blanc fixe, dry, bbl.	lb.	.04½–	.04¾
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.40 –	....
Borax, bbl.	lb.	.05½–	.05¾
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium carbide, drums	lb.	.04½–	.04¾
Calcium chloride, fused, drums	ton	22.00 –	23.00
Gran. drums	ton	28.00 –	30.00
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.86 –	.88
Carbon bisulphide, drums	lb.	.07 –	.07½
Carbon tetrachloride, drums	lb.	.10 –	....
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04¾
Domestic, heavy, bbl.	lb.	.03½–	.03¾
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, cylinders	lb.	.06 –	.06½
Chloroform, tech., drums	lb.	.35 –	.38
Cobalt oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	19.00 –	20.00
Copper carbonate, bbl.	lb.	.19 –	.20
Copper cyanide, drums	lb.	.47 –	.50
Copper sulphate, crys., bbl.	100 lb.	6.00 –	6.25
Cream of tartar, bbl.	lb.	.25½–	.26½
Epsom salt, dom., tech., bbl.	100 lb.	1.90 –	2.15
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.15
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.50 –	2.60
Ether, U.S.P., drums	lb.	.13 –	.15
Ethyl acetate, com., 85%, drums	gal.	.80 –	.85
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.95 –	1.00
Formaldehyde, 40%, bbl.	lb.	.14½–	.15½
Fullers earth—imp., powd., net	ton	$30.00 –	$32.00
Fusel oil, ref., drums	gal.	3.55 –	4.05
Fusel oil, crude, drums	gal.	2.30 –	2.40
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.85 –	.95
Glycerine, e.p., drums extra	lb.	.18 –	.18½
Glycerine, dynamite, drums	lb.	.16½–	.16¾
Glycerine, crude 80%, loose	lb	.11 –	.11¼
Iodine, resublimed	lb.	4.55 –	4.65
Iron oxide, red, casks	lb.	.12 –	.18
Lead: White, basic carbonate, dry, casks	lb.	.09½–	.10
White, basic sulphate, casks	lb.	.09½–	....
White, in oil, kegs	lb.	.12½–	.14
Red, dry, casks	lb.	.11½–	.12
Red, in oil, kegs	lb.	.13½–	.15
Lead acetate, white crys., bbl.	lb.	.13½–	.14
Brown, broken, casks	lb.	.12½–	....
Lead arsenate, powd., bbl.	lb.	.23 –	.24
Lime-Hydrated, bbl.	per ton	16.80 –	17.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½–	.11
Lithophone, bags	lb.	.07 –	.07½
in bbl.	lb.	.07 –	.07½
Magnesium carb., tech., bags	lb.	.08 –	.08½
Methanol, 95%, bbl.	gal.	1.18 –	1.20
Methanol, 97%, bbl.	gal.	1.20 –	1.22
Nickel salt, double, bbl.	lb.	.10½–	....
Nickel salts, single, bbl.	lb.	.11½–	....
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.35 –	.40
Phosphorus, yellow, cases	lb.	.30 –	.35
Potassium bichromate, casks	lb.	.11 –	.11½
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.07
Potassium chlorate, powd.	lb.	.07½–	.08
Potassium cyanide, drums	lb.	.45 –	.50
Potassium, first sorts, cask	lb.	.09	.09½
Potassium hydroxide (caustic potash) drums	lb.	.08½–	.09
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06½–	.07½
Potassium permanganate, drums	lb.	.22 –	.22½
Potassium prussiate, red, casks	lb.	.70 –	.75
Potassium prussiate, yellow, casks	lb.	.37 –	.37½
Salammoniac, white, gran., casks, imported	lb.	.07 –	.07½
Salammoniac, white, gran., b'bl., domestic	lb.	.07½–	.08
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk)	ton	26.00 –	28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.60 –	1.67
Soda ash, light, basis, 48%, bags, contract, f.o.b. wks.	100 lb.	1.20 –	1.30
Soda ash, light, 58%, flat, bags, resale	100 lb.	1.75 –	1.80
Soda ash, dense, bags, contract, basis 48%	100 lb.	1.17½–	1.20
Soda ash, dense, in bags, resale	100 lb.	1.85 –	1.90
Soda, caustic, 76%, solid, drums, f.a.s.	100 lb.	3.30 –	3.40
Soda, caustic, basis 60%, wks., contract	100 lb.	2.50 –	2.60
Soda, caustic, ground and flake, contracts	100 lb.	3.80 –	3.90
Soda, caustic, ground and flake, resale	100 lb.	3.72½–	....
Sodium acetate, works, bags	lb.	.05½–	.06¼
Sodium bicarbonate, bbl.	100 lb.	2.00 –	2.50
Sodium bichromate, casks	lb.	.08 –	....
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04¾
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.20 –	.23
Sodium fluoride, bbl.	lb.	$0.09½–	$0 10
Sodium hyposulphite, bbl.	lb.	.02½–	.03
Sodium nitrite, casks	lb.	.08 –	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.04
Sodium prussiate, yel. drums	lb.	.17½–	.18
Sodium silicate (40°, drums)	100 lb.	.80 –	1.25
Sodium silicate (60°, drums)	100 lb.	2.00 –	2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04½–	.04¾
Sodium sulphite, crys., bbl.	lb.	.03½–	.03¾
Strontium nitrate, powd., bbl.	lb.	.09½–	.10
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08½
Talc—imported, bags	ton	30.00 –	40.00
Talc—domestic powd., bags	ton	18.00 –	25.00
Tin bichloride, bbl.	lb.	.12½–	.13½
Tin oxide, bbl.	lb.	.50 –	....
Tin crystals, bbl.	lb.	.35½–	.36
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06 –	.07
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bbl.	lb.	.08 –	.08½
5% lead sulphate, bags	lb.	.07½–	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	2.50 –	3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.65 –	$0.80
Alpha-naphthol, ref., bbl.	lb.	.75 –	.90
Alpha-naphthylamine, bbl.	lb.	.36 –	38
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.24 –	.25
Anthracene, 80%, drums	lb.	.75 –	1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.70 –	.75
Benzaldehyde U.S.P., carboys	lb.	1.40 –	1.45
tech, drums	lb	75	80
Benzene, pure, water-white, tanks and drums	gal.	.30 –	.32
Benzene, 90%, tanks & drums	gal.	.27 –	.30
Benzene, 90%, drums, resale	gal.	.30 –	.33
Benzidine base, bbl.	lb.	.85 –	.90
Benzidine sulphate, bbl.	lb.	.70 –	.75
Benzoic acid, U.S.P., kegs	lb.	.72 –	75
Benzoate of soda, U.S.P., bbl.	lb.	.57 –	.65
Benzyl chloride, 95-97%, ref., drums	lb.	.45 –	....
Benzyl chloride, tech., drums	lb.	.30 –	.35
Beta-naphthol, subl., bbl.	lb.	.55 –	.60
Beta-naphthol, tech., bbl.	lb.	.23 –	.23½
Beta-naphthylamine, tech.	lb.	.80 –	.90
Carbazol, bbl.	lb.	.75 –	.90
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.30
Cresylic acid, 97%, resale, drums	gal.	1.30 –	....
95-97%, drums, resale	gal.	1.25 –	....
Dichlorbenzene, drums	lb.	.07 –	.09
Diethylaniline, drums	lb.	.50 –	.60
Dimethylaniline, drums	lb.	.42 –	.43
Dinitrobenzene, bbl.	lb.	.19 –	.20
Dinitroclorbenzene, bbl.	lb.	.22 –	.23
Dinitronaphthalene, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluene, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.25 –	.30
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.85 –	....
Meta-phenylenediamine, bbl.	lb.	1.00 –	1 05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.09½–	10
Naphthalene, balls, bbl.	lb.	.09½–	.10½
Naphthionate of soda, bbl.	lb.	.58 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.10 –	.12
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.15 –	.17
N-W acid, bbl.	lb.	1.25 –	1.30
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.17 –	.20
Ortho-nitrophenol, bbl.	lb.	.90 –	.92
Ortho-nitrotoluene, drums	lb.	.10 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.15
Para-amidophenol, base, kegs	lb.	1.20 –	1.30
Para-amidophenol, HCl, kegs	lb.	1.25 –	1.35
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.74 –	.75
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.95 –	.98
Phthalic anhydride, bbl.	lb.	.35 –	.38
Phenol, U.S.P., drums	lb.	.55 –	.57
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	
Pyridine, imp., drums	gal.	2.50 –	2.75

Resorcinol, tech., kegs	lb.	$1.40 –	$1.50
Resorcinol, pure, kegs	lb.	2.00 –	2.10
R-salt, bbl	lb.	.55 –	.60
Salicylic acid, tech., bbl	lb.	.47 –	.48
Salicylic acid, U.S.P., bbl	lb.	.50 –	.52
Solvent naphtha, water-white, drums	gal.	.37 –	.40
Crude, drums	gal.	.22 –	.24
Sulphanilic acid, crude, bbl	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Toluidine, kegs	lb.	1.20 –	1.30
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars	gal.	.30 –	.35
Toluene, drums	gal.	.35 –	.40
Xylidines drums	lb.	.45 –	.47
Xylene, pure, drums	gal.	.75 –	1.00
Xylene, com., drums	gal.	.37 –	.....
Xylene, com., tanks	gal.	.32 –	.....

Naval Stores

Rosin B-D, bbl. 280 lb.		$6.30 –	6.35
Rosin E-I, bbl. 280 lb.		6.35 –	5.46
Rosin K-N, bbl. 280 lb.		6.40 –	6.50
Rosin W.G.-W.W., bbl. 280 lb.		6.80 –	7.80
Wood rosin, bbl. 280 lb.		6.20 –	.....
Turpentine, spirits of, bbl	gal.	1.28 –	1.30
Wood, steam dist., bbl	gal.	1.22 –	1.24
Wood, dest. dist., bbl	gal.	1.05 –	1.10
Pine tar pitch, bbl. 200 lb.		..... –	6.00
Tar, kiln burned, bbl. 500 lb.		..... –	13.00
Retort tar, bbl. 500 lb.		..... –	12.00
Rosin oil, first run, bbl	gal.	.45 –	.....
Rosin oil, second run, bbl	gal.	.48 –	.....
Rosin oil, third run, bbl	gal.	.52 –	.....
Pine oil, steam dist	gal.	.80 –	.....
Pine oil, pure, dest. dist	gal.	.75 –	.....
Pine tar oil, ref	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla	gal.	.32 –	.32½
Pine tar oil, double ref., bbl	gal.	..... –	.75
Pine tar, ref., thin, bbl	gal.	..... –	.25
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ –	$0.04½
Grease, yellow, bbl	lb.	.08 –	.08½
Lard oil, Extra No. 1, bbl	gal.	.92 –	.94
Neatsfootoil, 20 deg. bbl	gal.	1.30 –	.....
No. 1, bbl	gal.	.92 –	.94
Oleo Stearine		.10½ –	.....
Red oil, distilled, d.p. bbl	lb.	.11 –	11½
Saponified, bbl	lb.	.11 –	11½
Tallow, extra, loose	lb.	.08½ –	.....
Tallow oil, acidless, bbl	gal.	.95 –	.97

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.14 –	.....
Castor oil, No. 1, bbl	lb.	.14½ –	.....
Chinawood oil, bbl	lb.	.38 –	.40
Coconut oil, Ceylon, bbl	lb.	.10½ –	10½
Ceylon, tanks, N.Y	lb.	.09½ –	.....
Coconut oil, Cochin, bbl	lb.	.10½ –	.....
Corn oil, crude, bbl	lb.	.12½ –	.....
Crude, tanks, (f.o.b. mill)	lb.	.10½ –	.10½
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ –	.10
Summer yellow, bbl	lb.	.12½ –	.12½
Winter yellow, bbl	lb.	.13½ –	.13½
Linseed oil, raw, car lots, bbl	gal.	1.17 –	.....
Raw, tank cars (dom.)	gal.	1.12 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.19 –	.....
Olive oil, denatured, bbl	gal.	1.15 –	.....
Sulphur, (foots) bbl	lb.	.10 –	10½
Palm, Lagos, casks	lb.	.08½ –	.08½
Niger, casks	lb.	.07½ –	.08
Palm kernel, bbl	lb.	.09½ –	.10
Peanut oil, crude, tanks (mill)	lb.	.13½ –	.....
Peanut oil, refined, bbl	lb.	.17 –	.....
Perilla, bbl	lb.	.16½ –	.16½
Rapeseed oil, refined, bbl	gal.	.84 –	.85
Rapeseed oil, blown, bbl	gal.	.90 –	.91
Sesame, bbl	lb.	.12½ –	.13
Soya bean (Manchurian), bbl.	lb.	.13½ –	.....
Tank, f.o.b. Pacific coast	lb.	.10 –	.....
Tank, (f.o.b. N.Y.)	lb.	.10½ –	.10½

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.70 –	$0.72
Menhaden, light pressed, bbl.	gal.	.76 –	.....
White bleached, bbl	gal.	.78 –	.....
Blown, bbl	gal.	.82 –	.....
Crude, tanks (f.o.b. factory)	gal.	.50 –	.52
Whale No. 1 crude, tanks, coast	lb.	.08 –	.....
Winter, natural, bbl	gal.	.76 –	.78
Winter, bleached, bbl	gal.	.79 –	.80

Oil Cake and Meal

Coconut cake, bags	ton	$32.00 –	.....
Copra, sun dried, bags, (c.i.f.)	lb.	.05½ –	.....
Sun dried Pacific coast	lb.	.05½ –	.....
Cottonseed meal, f.o.b. mills	ton	39.00 –	40.00
Linseed cake, bags	ton	36.50 –	.....
Linseed meal, bags	ton	38.50 –	.....

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	.80 –	.85
Cochineal, bags	lb.	.35 –	.36
Cutch, Borneo, bales	lb.	.04½ –	.05
Cutch, Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags 100 lb.		3.64 –	3.69
Dextrine, gum, bags 100 lb.		3.99 –	4.09
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	28.00 –	30.00
Logwood, chips, bags	lb.	.02½ –	.03½
Sumac, leaves, Sicily, bags	ton	$70.00 –	$72.00
Sumac, ground, bags	ton	65.00 –	67.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags 100 lb.		2.97 –	3.07
Tapioca flour, bags	lb.	.05½ –	.06½

Extracts

Archil, conc., bbl	lb.	$0.17 –	$0.18
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl	lb.	.04 –	.05
Fustic, crystals, bbl	lb.	.20 –	.22
Fustic, liquid, 42°, bbl	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08 –	.09
Hematine crys., bbl	lb.	.14 –	.18
Hemlock, 25% tannin, bbl	lb.	.04 –	.05
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl	lb.	.14 –	.17
Logwood, crys., bbl	lb.	.19 –	.20
Logwood, liq., 51°, bbl	lb.	.09 –	.10
Quebracho, solid, 65% tannin, bbl	lb.	.04½ –	.05
Sumac, dom., 51°, bbl	lb.	.06½ –	.07

Dry Colors

Blacks–Carbongas, bags, f.o.b. works	lb.	$0.16 –	$0.18
Lampblack, bbl	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl	lb.	.55 –	.60
Prussian, bbl	lb.	.55 –	.60
Ultramarine, bbl	lb.	.08 –	.35
Browns, Sienna, Ital., bbl	lb.	.06 –	.14
Sienna, Domestic, bbl	lb.	.03½ –	.04
Umber, Turkey, bbl	lb.	.04 –	.04½
Greens–Chrome, C.P. Light, bbl	lb.	.32 –	.34
Chrome, commercial, bbl	lb.	.12 –	.12½
Paris, bulk	lb.	.30 –	.35
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl	lb.	1.30 –	1.32
Yellow, Chrome, C.P. bbls	lb.	.20 –	.21
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl	lb.	$0.28 –	$0.30
Beeswax, crude, bags	lb.	.20 –	.23
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candellila, bags	lb.	.24 –	.25
Carnauba, No. 1, bags	lb.	.42 –	.43
No. 2, North Country, bags	lb.	.23 –	.23½
No. 3, North Country, bags	lb.	.19½ –	.....
Japan, cases	lb.	.14½ –	.15
Montan, crude, bags	lb.	.04½ –	.04½
Paraffine, crude, match, 105-110 m.p.	lb.	.04½ –	.04½
Crude, scale 124-126 m.p., bags	lb.	.03 –	.03½
Ref., 118-120 m.p., bags	lb.	.03½ –	.....
Ref., 125 m.p., bags	lb.	.03½ –	.....
Ref. 128-130 m.p., bags	lb.	.04½ –	.04½
Ref., 133-135 m.p., bags	lb.	.05 –	.....
Ref., 135-137 m.p., bags	lb.	.05½ –	.05½
Stearic acid, agle pressed, bags	lb.	.13½ –	.....
Double pressed, bags	lb.	.14½ –	.....
Triple pressed, bags	lb.	.15½ –	.16

Fertilizers

Ammonium sulphate, bulk, f.o.b. works 100 lb.		$3.25 –	$3.30
F.a.s. double bags 100 lb.		3.85 –	3.90
Blood, dried, bulk	unit	4.25 –	.....
Bone, raw, 3 and 50, ground	ton	27.00 –	30.00
Fish scrap, dom., dried, wks.	unit	nominal	
Nitrate of soda, bags 100 lb.		2.60 –	2.65
Tankage, high grade, f.o.b. Chicago	unit	3.25 –	3 50
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	35.00 –	36.00
Potassium sulphate, bags basis 90%	ton	45.67 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.28 –	.....
Upriver coarse	lb.	.23 –	.....
Upriver caucho ball	lb.	.25 –	.....
Plantation—First latex crepe	lb.	.31 –	.....
Ribbed smoked sheets	lb.	.31 –	.....
Brown crepe, thin, clean	lb.	.29 –	.....
Amber crepe No. 1	lb.	.29½ –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.12 –	$0.13
East Indian, bold, bags	lb.	.23 –	.23½
Manila, pale, bags	lb.	.20 –	.20½
Pontinak, No. 1 bags	lb.	.20 –	.20½
Damar, Batavia, cases	lb.	.30½ –	.31
Singapore, No. 1, cases	lb.	.34½ –	.35
Singapore, No. 2, cases	lb.	.24 –	.25
Kauri, No. 1, cases	lb.	.65 –	.67
Ordinary chips, cases	lb.	.18 –	.20
Manjak, Barbados, bags	lb.	.09 –	.09½

Shellac

Shellac, orange fine, bags	lb.	$0.72 –	.....
Orange superfine, bags	lb.	.74 –	.76
A. C. garnet, bags	lb.	nominal	
Bleached, bonedry	lb.	.82 –	.84
Bleached, fresh	lb.	.70 –	.71
T. N., bags	lb.	.69 –	.70

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$500.00 –	.....
Asbestos, shingle, f.o.b., Quebec	sh. ton	$65.00 –	$85.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 –	25.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl	net ton	28.00 –	.....
Barytes, crude f.o.b. mines, bulk	net ton	10.00 –	11.00
Casein, bbl., tech	lb.	.22½ –	.25
China clay (kaolin) crude, f.o.b. Ga	net ton	7.00 –	9.00
Washed, f.o.b. Ga	net ton	8.00 –	9.00
Powd., f.o.b. Ga	net ton	14.00 –	20.00
Crude f.o.b. Va	net ton	8.00 –	12.00
Ground, f.o.b. Va	net ton	14.00 –	20.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	6.00 –	7.00
No. 2 pottery	long ton	4.00 –	5.50
No. 1 soap	long ton	7.00 –	7.50
No. 1 Canadian, f.o.b. mill	long ton	20.00 –	22.00
Graphite, Ceylon, lump, first quality, bbl	lb.	.06½ –	.....
Ceylon, chip, bbl	lb.	.05½ –	.....
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.15 –	.16
Gum tragacanth, sorts, bags	lb.	.50 –	.60
No. 1, bags	lb.	1.60 –	1.65
Kieselguhr, f.o.b. Cal	ton	40.00 –	42.00
F.o.b. N. Y	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl	lb.	.05 –	.05½
Dom., ground, bbl	lb.	.06 –	.07
Silica, glass sand, f.o.b. Ind	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill	ton	17.00 –	17.50
Silica, bldg. sand, f.o.b. Pa	ton	2.00 –	2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 –	20.00

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.50 –	.....
Corning	bbl.	2.00 –	.....
Cabell	bbl.	2.16 –	.....
Somerset	bbl.	1.95 –	.....
Illinois	bbl.	2.17 –	.....
Indiana	bbl.	2.18 –	.....
Kansas and Oklahoma, 28 deg.	bbl.	1.40 –	.....
California, 35 deg. and up	bbl.	1.04 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.22½ –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.21½ –	.....
Kerosene, ref. tank wagon	gal.	.14 –	.....
Bulk, W. W. export	gal.	.07 –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.27 –	.30
Bloomless, 30@31 grav	gal.	.20 –	.22
Paraffin, pale	gal.	.24 –	.25
Spindle, 200, pale	gal.	.25 –	.26
Petrolatum, amber, bbls	lb.	.05 –	.05½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	40–4
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–69
9-in. arches, wedges and keys	ton	80–85
Scrape and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N. Y	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11½ –	.11½
4-6% C	lb.	.12 –	.13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	120.00 –	.....
Spiegeleisen, 19-21% Mn	gr. ton	40.00 –	.....
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.70
Ferrosilicon, 10-15%	gr. ton	48.00 –	50.00
50%	gr. ton	95.00 –	.....
75%	gr. ton	150.00 –	160.00

Ferrotungsten, 70-80%, per lb. of W	lb.	$0.90 - $0.95
Ferro-uranium, 35-50% of U. per lb. of U	lb.	6.00 -
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 - 3.75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$6.00 - $9.00
Chrome ore Calif. concentrates, 50% min. Cr_2O_3.	ton	22.00 - 23.00
C.i.f. Atlantic seaboard	ton	20.50 - 24.00
Coke, fdry., f.o.b. ovens	ton	7.00 - 7.50
Coke, furnace, f.o.b. ovens	ton	6.00 - 6.50
Fluorspar, gravel, f.o.b. mines' Illinois	ton	20.00 - 21.50
Ilmenite, 52% TiO_2	lb.	.01½- .01¾
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.33 -
Manganese ore, chemical (MnO_2)	ton	75.00 - 80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 - .70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 - .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½- .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½- .12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12
Rutile, 95% TiO_2	lb.	.12 -
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 - 8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 - 8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 - 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 - 2.50
Vanadium pentoxide, 99%	lb.	12.00 - 14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 -
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.04½- .13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	16½- 16¾
Aluminum, 98 to 99%	23-24
Antimony, wholesale, Chinese and Japanese	7½- 8¼
Nickel, virgin metal	28-30
Nickel, ingot and shot	30-
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	44.00
Lead, New York, spot	7.75
Lead, E. St. Louis, spot	7.58
Zinc, spot, New York	7.10
Zinc, spot, E. St. Louis	6.75

Other Metals

Silver (commercial)	oz.	$0.67¼
Cadmium	lb.	1.00
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	2.65@2.85
Magnesium, ingots, 99%	lb.	1.25-
Platinum	oz.	115.00
Iridium	oz.	260.00@275.00
Palladium	oz.	79.00
Mercury	75 lb.	68.00-69.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	25 50
Copper bottoms	30 75
Copper rods	25 25
High brass wire	19 50
High brass rods	17.00
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	25.25
Seamless high brass tubing	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	11.30@11.50
Copper, heavy and wire	11 25@11 50
Copper, light and bottoms	9.25@ 9 50
Lead, heavy	5.75@ 6 00
Lead, tea	3.50@ 3 75
Brass, heavy	6.25@ 6 40
Brass, light	5.35@ 5 75
No. 1 yellow brass turnings	6.30@ 6.50
Zinc	3.50@ 4.00

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.29	$3.14
Soft steel bars	3.19	3.04
Soft steel bar shapes	3.19	3.04
Soft steel bands	3 29	3.19
Plates, ¼ to 1 in. thick	3.29	3.14

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Arizona

GLOBE—The New Dominion Copper Co. will make extensions and improvements at its plant to cost approximately $250,000, including the installation of additional equipment.

Arkansas

EL DORADO—The Richardson Oil Co. has tentative plans under consideration for the rebuilding of the portion of its plant destroyed by fire, April 18, with loss estimated at $75,000, including equipment.

California

SAN FRANCISCO—The Paraffine Companies, Inc., 34 1st St., has plans in preparation for extensions and improvements in its 3-story plant on South Brannan St., near 3rd St., 275x275 ft., estimated to cost close to $40,000. The company has also broken ground for a plant addition at Antioch.

SAN BERNARDINO—The Inland Oil Refinery Co., recently organized, has acquired property on West Rialto Ave. for the construction of a new refining plant, to consist of a number of units. Plans are under way for the first unit, estimated to cost about $100,000, with machinery.

LOS ANGELES—The Royal Dutch-Shell Oil Companies, Inc., 343 Sansome St., San Francisco, has negotiations under way for the purchase of property at Watson Station, Wilmington, Los Angeles, as a site for a new refining plant. It is reported that the initial works will cost in excess of $500,000.

FULLERTON—The Newton Process Co. has acquired a tract of land, totaling about 30 acres, as a site for a new gasoline-refining plant, to operate under a recently perfected process. Plans will be prepared immediately. The company previously operated a plant at Santa Fe Springs, Calif. J. H. and George Wentz, Anaheim, are heads.

Colorado

DENVER—The Producers' & Refiners' Corp., California Bldg., has construction in progress on a new oil refinery at its properties in Wyoming, and plans for the early installation of machinery. The initial unit will have a capacity of 10,000 bbl. per day.

Illinois

CHICAGO—The Standard Glass Co., 2533 Cottage Grove Ave., has filed plans for a new 2-story plant, 30x50 ft., at 2629 South Park Ave. R. A. Williamson, 15 South LaSalle St., is architect.

ARGO—The Corn Products Refining Co. will commence immediately to rebuild the portion of its local plant destroyed by fire April 20, caused by an explosion. The estimated loss has not been announced.

CHICAGO—The National Lead Co., 900 West 18th St., will build a 1-story addition 35x100 ft., at its plant, 1714 Peoria St.

Indiana

VINCENNES — The Blackford Window Glass Co. will expend close to $500,000 for machinery for installation at its new local plant, on which construction has been commenced. The works will cost approximately $800,000, complete.

SHELBYVILLE—The Shelbyville Mirror Co., 450 East Henricks St., has tentative plans for the construction of a new plant, estimated to cost close to $50,000 with equipment.

HUNTINGTON—The Indiana Rubber Products Co., recently organized, has commenced the remodeling of its proposed local works, comprising the former plant of the Rapid Rim Co., and will convert for a modern rubber factory. The installation of machinery will soon be commenced. C. H. McDermott is president.

Kentucky

OWENSBORO — New gas-purifying and scrubbing equipment will be installed at the local artificial gas plant of the Kentucky Public Service Co., estimated to cost approximately $35,000.

Louisiana

SWARTZ—The Century Carbon Co. has awarded a contract to the Rumbarger Engineering Co., Monroe, for the construction of a new carbon black plant on local site recently acquired, estimated to cost approximately $250,000, including machinery.

Maine

RUMFORD—In connection with proposed improvements and new equipment at its local mill to cost about $250,000, previously announced, the Oxford Paper Co. purposes to build a complete new plant unit estimated to cost approximately $1,000,000, with machinery. Plans will be drawn at an early date.

Maryland

BALTIMORE—The United States Industrial Chemical Co. has completed plans for the construction of a 1-story addition to its plant on the Patapsco County Rd., 50x250 ft.

Massachusetts

STOUGHTON—The Meade Rubber Co. has commenced the construction of a 2-story addition, to increase the plant output about 50 per cent. A list of machinery to be installed will soon be arranged. E. R. Simpson, 176 Federal St., Boston, is engineer.

AMHERST—The State Agricultural College has perfected plans for the immediate resumption of construction on the proposed chemical laboratory on the campus, and purposes to push the structure to completion. It will be 3-story, 44x112 ft., estimated to cost close to $300,000, with equipment.

CAMBRIDGE—The Lever Brothers Co., Portland St., manufacturer of soaps, washing compounds, etc., will commence extensions and improvements in its plant to cost approximately $30,000.

LEOMINSTER—The Viscaloid Co., manufacturer of composition products, has construction under way on a new 2-story plant, 40x100 ft., on Lancaster St., estimated to cost $27,000.

Michigan

STURGIS—D. A. Hopping is perfecting the organization of a company to take over and operate the plant of the Utility Mfg. Co., recently acquired, for the manufacture of paper products. The structure will be remodeled and improved, and equipment installed.

Minnesota

MINNEAPOLIS—The Twin City Brass & Aluminum Foundry Co., 815 Washington St., S. E., has tentative plans for the rebuilding of the portion of its plant destroyed by fire, April 21, with loss approximating $25,000.

ST. PAUL—The Waldorf Paper Products Co. will soon take bids for the construction of a new mill, estimated to cost close to $100,000, including equipment.

Mississippi

JACKSON—The Buckeye Cotton Oil Co., Mill St., is perfecting plans for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at about $30,000. Additional equipment will be installed.

Missouri

JOPLIN—The General Explosives Co. will rebuild the portion of its plant destroyed

by an explosion on April 25. An official estimate of loss has not been announced.

ST. LOUIS—The Columbia Oil Co., 3417 Papin St., has plans for the construction of a new storage and distributing plant to replace its works lately destroyed by fire with loss estimated at about $75,000, including equipment.

Montana

GREAT FALLS—The Sunburst Refining Co. has increased the appropriation for its new oil-refining plant on site recently acquired at West Great Falls, and the initial unit will be enlarged. It is estimated to cost about $300,000, with machinery. W. M. Parker is construction engineer, and E. T. Wyatt general manager.

New Jersey

NEWARK—Kaufherr & Co., 42 Garden St., operating a leather tannery, have filed plans for the erection of a 1-story addition and will commence work at once.

BLOOMFIELD—The Condensite Co., Grove St., has broken ground for the construction of a new addition to its rubber insulation plant, estimated to cost approximately $35,000.

New York

BROOKLYN—The Ancasco Chemical & Color Co., Inc., 123 Nostrand Ave., is arranging for the immediate occupancy of its proposed new plant at 61-63 Taaffe Pl., where property recently was leased. It will be equipped for the production of shellac, wood finishers and kindred products.

TONAWANDA—The National Roofing Co., Fillmore Ave., manufacturer of composition roofing products, is planning for the rebuilding of the portion of its plant destroyed by fire, April 20, with loss estimated at $75,000, including equipment.

TOTTENVILLE, S. I.—The Tottenville Copper Co., Arthur Kill Rd. and Bethel Ave., has authorized plans for the rebuilding of the portion of its plant destroyed by fire April 22, comprising eleven buildings with machinery, with loss estimated at close to $1,000,000. The rebuilding will cost approximately a like amount. Benjamin Lowenstein is president.

Ohio

MIDDLETOWN—Officials of the Paul A. Sorg Paper Co. have organized a subsidiary company to be known as the Frank Smith Paper Co., with capital of $1,500,000, to construct and operate a local mill. Plans have been completed for a 1-story mill unit, 250x600 ft., estimated to cost about $750,000, with machinery. Pretzinger & Musselman, Reibold Bldg., Dayton, O., are architects.

SEBRING—The Sebring Pottery Co. has work in progress on a new addition for increased production, estimated to cost about $30,000.

CINCINNATI—The Chemical Utilities Co., 1516 West 6th St., has plans for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $50,000.

Oregon

ASTORIA—The Crown-Willamette Paper Co., 248 Battery St., San Francisco, Calif., has tentative plans under consideration for the construction of a new pulp mill at Young's River Falls, near Astoria, to cost more than $150,000 with equipment.

OREGON CITY—The Oregon Pulp & Paper Co. will soon commence the erection of a 3-story addition, estimated to cost about $75,000.

Pennsylvania

PHILADELPHIA—Woodward & Dickerson, Inc., 14 South Delaware Ave., manufacturer of fertilizer products, will make extensions and improvements in its plant at 143-5 Front St.

LEWISTOWN—The Pennsylvania Wire Glass Co., Pennsylvania Bldg., Philadelphia, is completing plans for the erection of the first unit of a new local plant, 100x500 ft., to cost in excess of $200,000, with machinery. Frank A. Hayes is engineer.

PITTSBURGH—The Standard Sanitary Mfg. Co., Bessemer Bldg., has filed plans for the erection of two additions to its plant at Preble Ave. and Ontario St., estmated to cost $70,000.

SPARTANSBURG—The Spartansburg Oil & Gas Co., lately organized, has broken ground for the construction of a new oil-refining plant to cost close to $200,000, with machinery.

South Carolina

LORIS—Rhodes & Hardwick are planning for the installation of a fertilizer plant in a local building, with initial capacity of about 75 tons per day.

Tennessee

KNOXVILLE—The Knoxville Glass Co. is arranging for the immediate erection of a new 2-story plant on North Broadway, est'mated to cost close to $50,000. H. G. Kinney is head.

ERWIN—The Southern Potteries Co. is perfecting plans for the erection of a new plant addition, estimated to cost close to $200,000, with machinery. Charles W. Foreman is head.

Texas

BUNGER—The Phillips Petroleum Co., Bartlesville, Okla., has commenced the construction of four new gasoline-refining plants at Bunger, Oil City, South Bend and Herron City, all in the same district, to cost about $700,000, including machinery.

HOUSTON—The Pinetree Products Co., West Bldg., has acquired property at Harrisburg, near Houston, for the erection of a new plant for the production of turpentine, paint, varnish, etc., with initial capacity of about 6,000 gal. per day. J. W. Barnes is general manager.

ROCKDALE—The Austin Petroleum Co. will commence the construction of an addition to its local oil-refining plant, to increase the capacity by about 100 bbl. per day. The company was organized recently with A. C. Baldwin as president.

SAN ANTONIO—The San Antonio Portland Cement Co. has completed plans and will commence the construction of an addition to its mill for considerable increase in production. Willard E. Simpson is engineer.

BRECKENRIDGE—R. W. Raney is perfecting plans for the organization of a new company to construct and operate a plant in this vicinity for the manufacture of carbon black. It will cost about $200,000, including machinery. Permission has been granted and work will soon be commenced.

EL PASO—J. B. Spears, an official of Wells, Stilwell & Spears, Inc., has acquired a local building and adjoining site for the establishment of a new cottonseed oil mill. The structure will be improved and extended. The machinery installation is estimated to cost close to $60,000.

Virginia

RICHMOND—The Calcium Phosphate & Fertilizer Corp. has preliminary plans for the installation of additional equipment at its plant.

RICHMOND—The Economy Concrete Co., Inc., recently organized with a capital of $100,000, has acquired a tract of about 5 acres of land and plans for the construction of a new plant. It will cost about $45,000, including equipment. J. Scott Parrish is president.

Washington

ABERDEEN—The Western Oil Co. is planning for the construction of a new oil storage and distributing plant to cost about $40,000, including equipment. A similar plant will also be built at Hoquiam, Wash., to cost approximately a l'ke amount.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS and all kinds fertilizers. All cattle feeding cakes. Purchase or agency. —6185.

LAUNDRY TABLETS in cake form. Bergen, Norway. Manufacturers' agency. Samples with offers des'red.—6189.

CAMEL-HAIR FILTER-PRESS CLOTH. Alexandria, Egypt. Purchase. A sample showing the quality of cloth desired was forwarded and may be examined at the bureau or its district offices. (Refer to file 88,793.) —6193.

PARAFFIN and general drugs and chemicals. Oporto, Portugal. Purchase.—6205.

NITRATE OF SODA, about 10 tons; muriate of potash, about 15 tons; and phosphoric acid, about 10 tons. San Jose, Costa Rica. Purchase.—6206.

New Companies

WYATT RUBBER & CHEMICAL CO., 4000 Gough St., Baltimore, Md.; chemicals and rubber products; $50,000. Incorporators: Charles M. and C. E. Wyatt, and J. Lewis Warner.

PROTECTIVE COATINGS CORP., Kenilworth, N. J.; waterproofing products; 7,000 shares of stock, no par value. Incorporators: Thomas D. Osbourne, J. N. Dimmick and A. R. MacConnell, all of Kenilworth.

AMERICAN OLYMPIC OIL & REFINING CO., Bangor, Me.; refined petroleum products; $980,000. Frank Fellows, president; Raymond Fellows, treasurer; and James M. Gillian, Bangor, clerk and representative.

NEWTOWN BY-PRODUCTS MFG. CO., Brooklyn, N. Y.; oils, greases, etc.; $100,000. Incorporators: E. P. Arnold, E. R. Bohart and F. E. Ames, Brooklyn. Representative: F. J. Knorr, Albany, N. Y.

LIME BY-PRODUCTS CORP., Charleston, W. Va.; cement, lime, etc.; $500,000. Incorporators: M. F. Matheny, J. S. Horan and G. L. Hartley, all of Charleston.

PACIFIC COAST FIBRE CO., Seattle, Wash.; fiber products; $750,000. Incorporators: Cassius E. Gates, S. F. Harwood. Representative: Hulbert, Gates & Helsell, 901 Alaska Bldg.

HIMMELEIN & BAILEY, INC., Camden, N. J.; operate a leather tannery; $200,000. Incorporators: Frederick and F. E. Himmelein, and William G. Oaks, 807 Cooper St., Camden. The last noted is representative.

GELTAN CO., New York, N. Y.; glue and other adhesive products; $300,000. Incorporators: John K. Tullis, Henry G. Stone and Edward M. Roche. Representative: Corporation Trust Co. of America, du Pont Bldg., Wilmington, Del.

NORTH BRANCH OIL CORP., Olean, N. Y.; refined petroleum products; $500,000. Incorporators: H. L. Jacoby, J. I. Trenkle and A. E. Yahn. Representative: J. P. Quigley, Olean.

ENTERPRISE PAPER CO., Philadelphia, Pa.; paper products; $125,000. Nathan D. Isen, 2002 North Eighth St., is treasurer and representative.

ACME TILE MFG. CO., St. Petersburg, Fla.; cement tile and kindred products; $25,000. Harry Forkel, president; and Robert Arnold, secretary and treasurer, both of St. Petersburg.

GORDON REFINING CO., Wilmington, Del.; refined petroleum products; $5,000,000. Representative: Capital Trust Co. of Delaware, Dover, Del.

SOAP PRODUCTS CORP., St. Louis, Mo.; soaps, washing powders, etc.; $50,000. Incorporators: W. C. Harris, C. B. Brockett and F. S. Henderson, all of St. Louis.

UNITED PLATE GLASS CORP., Bridgeport, Conn.; glass products; $125,000. Incorporators: M. Cohen and Irving Elson, 400 Meigs Bldg., Bridgeport.

W. P. COLLINS OIL CO., 2619 Mary St. Chicago, Ill.; refined oils; 900 shares of stock, no par value. Incorporators: John J., Thomas P. and William J. Collins.

UNITED STATES SHEEPSKIN TANNING CORP., Brooklyn, N. Y.; leather tanning; $25,000. Incorporators: A. E. Wolz, H. Oppenheim and T. J. Healy. Representative: M. P. Schaffer, 1457-63 Broadway, New York.

AMERICAN CACTUS RUBBER PRODUCTS CO., Wilmington, Del.; rubber goods; $500,000. Representative: Colonial Charter Co., Ford Bldg., Wilmington.

STANDARD SOAP CORP., Oakland, Calif.; soaps, washing compounds, etc.; $1,000,000. Incorporators: John M. Simpson, Irving D. Hicok and A. E. Lees. Representat've: Benjamin F. Woolner, First National Bank Bldg., Oakland.

DYDRA CHEMICAL PRODUCTS CO., Akron, O.; chemicals and chemical byproducts; $10,000. Incorporators: J. C. Timberous and C. E. Mills, both of Akron.

CUSTER PETROLEUM CORP., Wilmington, Del.; petroleum products; $250,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

INTERSTATE REFINERIES, INC., Kansas City, Mo.; operate oil refineries; $50,000. Incorporators: R. L. Langley, W. M. Bonner and J. O. Galloway, all of Kansas City.

EXCELSIOR CHEMICAL CO., 485 Cal'fornia St., San Francisco, Calif.; chem'cals and chemical byproducts; organized with Anton Schaffhauser as head.

UNITED SUGAR CO., Kennebunk, Me., operate a sugar refinery; $2,000,000. John F. Deering, president; John C. Emmons, treasurer and representative, both of Kennebunk.